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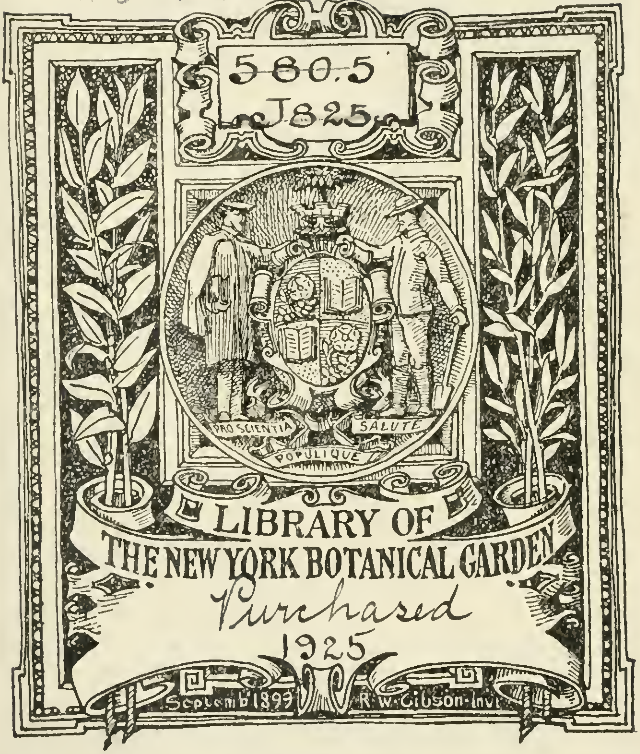

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JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE
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BRITISH AND FOREIGN.

ORCHIS LATIFOLIA IN BRITAIN.

By Rev. T. Stephenson, D.D., and T. A. Stephenson, M.Sc.

In discussing the problem of *Orchis latifolia* we cannot get any help from the specimen in Linnæus' Herbarium. The plant has rather short, broad leaves, the lowest 11 cm. by 2·5 cm. It is widest half-way between the middle and the base. The bracts are long and broad, the flowers broad, with side-lobes of the lip hardly crenulate, and centre-lobe rounded. It cannot be seen whether the leaves were originally spotted or not.

In his description (*Species Plantarum*, Edn. 1, p. 194) Linnæus says "folia parum maculata præsertim inferiora." In this connection "parum" should mean "slightly." From the reference to "Bauh. Pin. p. 86" and the other works, it would seem that he might admit some unspotted forms.

In his article on the British Marsh Orchises in the *Orchid Review* (xxvi. p. 164, 1918) Mr. Rolfe says that the *O. latifolia* of Linnæus *never* has spotted leaves. This is totally to ignore the description of Linnæus himself. The Continental writers generally describe *O. latifolia* as a plant with spotted leaves: Klinge says leaves *always* spotted; Camus, leaves spotted or not; Rouy, leaves usually spotted; Schulze, leaves generally spotted; Coste, leaves often spotted with brown. Most of the figures in Reich. Icon. Fl. Germ. are of plants with spotted leaves, and so also are the figures of Schulze, Coste, and Camus. Some figures also have unspotted leaves—e.g. *Flora Danica*, t. 266, which is good "*prætermissa*," Smith, E. B. t. 2308, and Curtis, Fl. Londinensis, 250, which are *O. incarnata*.

Nov. 12/25

Naturally it must be kept in mind that amongst all the spotted types there are unspotted individuals. In this case reversion seems to be easy. Unspotted examples of *O. ericetorum* are often found, and perhaps more often of *O. Fuchsii*. The same is true of both forms of *O. purpurella*, and it would be expected to occur in the case of *O. latifolia*. Even then the plants with incurved lip, stronger looped pattern, and coarser texture of flower would be distinguishable from *O. prætermissa* of the ordinary type, and by their usually lighter colour, *less* heavy pattern, and broader leaves from the darker or "northern" form of *O. prætermissa*. In the case of hybrids, some have and some have not spots or rings. Even when both parents have spots, it is just possible that some individual arising from the cross might be unspotted.

It is necessary first to consider the connection of *O. prætermissa* Druce with *O. latifolia* L. If Rolfe is right, the former is nothing but "true" *latifolia*. It is interesting to note that the botanists of Winchester College had discriminated this plant as a second type of *O. incarnata*. On this, see Bot. Soc. & Exch. Club Report, 1917, p. 174, and the whole article by Dr. Druce on the British Palmate Orchids. Another form with unspotted leaves has also to be considered. This is abundant in Scotland, and, in our view, should be placed under *O. prætermissa*, from which it differs in having a richer purple colour of the lip, with much heavier markings, and often slender narrow leaves. Although called by Druce "northern *incarnata*," it must be distinguished from the plant which he has named *O. incarnata* v. *pulchella* *.

We regard *O. prætermissa* as certainly a distinct species, the identification of which is a great advance towards the complete elucidation of the puzzling forms of the Palmate Orchids. If this species, as well as the "northern *incarnata*" be ruled out, we are left with a number of types of *O. latifolia*, of which most individuals have spotted leaves. The lip-types of *O. prætermissa* and of its "northern" form are given in Journ. Bot. 1920, pt. 556, figs. 5–8.

In discussing the varieties of *O. latifolia* the question arises as to whether, the unspotted forms being eliminated, we have a true species left, and not a mere congeries of hybrids. As regards British forms, this opinion appears to be tending to dominate, and it may be venturesome to resist it. Yet we do not think the question by any means decided in that sense. Dr. Druce (B. E. C. Club Report for 1917, p. 169) says, "It is evident that much further field-work will have to be done before it is safe to reject *latifolia* as a British plant." Perhaps he would to-day grant even less than this. Dr. Heslop Harrison has found *O. latifolia* in Durham, in profusion, far from other plants. Winchester botanists, quoted by Druce (*l. c.* p. 175), consider that *O. latifolia* "is distinct from evident first-generation hybrids, and possibly exists as a constant species in places where one of the so-called parents does not any longer exist. It may possibly represent the result of hybrids self-fertilizing for some generations and so producing in time a type breeding true, but this point again must be decided by experiment." This statement is open to some criticism from the Mendelian standpoint, since, if a type breeds true it is not due to any time-factor, but to the homozygous character of the uniting germ-cells. Another suggestion (*l. c.* p. 177) is "that the Marsh Orchids constitute either a recent group which has not yet settled down into a well-defined species, or else a species that has become variable and is breaking up into three types." Two quite distinct points have to be dealt with, one whether *O. latifolia* is ever found growing apart from other forms, in such numbers and of such uniformity of type as to give fair presumption that it is pure, and the second, whether, when it *is* found growing with other forms, it is bound to be a hybrid.

---

* Dr. Druce has now published a description of this form in B. E. C. Report, 1919, p. 577. He names it *O. prætermissa* v. *pulchella*, as it is closely similar to the v. *pulchella* of *O. incarnata* already so named by him (B. E. C. Rep. 1917, p. 167).

On the first point, Col. Godfery (Journ. Bot. 1919, 138) quotes abundant evidence of the occurrence on the Continent of *O. latifolia* in plenty, of perfectly regular type, with spotted leaves, where no *O. maculata* could be found. If this species is thus certified for the Continent, it may very well be taken as probable that the very similar forms found in Britain are also true *latifolia*, even though they may be proved to be of slightly divergent types.

If of hybrid derivation, the prevalent forms would have to be referred to *O. prætermissa* and *O. maculata* for their parentage. This, however, would *not* hold good in the case of a fairly large batch of plants of *O. latifolia* which grows near the railway-line close to Borth. Here are many dark forms along with some lighter ones which may be hybrids, where *O. ericetorum* is present, but no trace of *O. prætermissa*. At some distance, in the bog, *O. incarnata* grows, with pale leaves, usually very narrow; but we should doubt its influence here. There is at least the possibility that *O. latifolia* is pure. Wherever else we have found it hitherto, *O. prætermissa* has been alongside.

Taking up the second point, we think that our extended note on the bearing of the Mendelian theory on our problem has shown that a true species may arise from a cross, as well as from a mutation or series of mutations. Apart from experimental crossing, the pure forms could only be detected by such facts as their persistence through several generations, which would afford a presumption that they were breeding true, and their wide distribution, taken along with distinctness and uniformity of type. As our own preference is decidedly for the mutation theory of their origin, we may say here that the bold and distinct type of lip-pattern of *O. latifolia* does not by any means suggest to us a cross. Mr. R. D. Laurie, M.A., of Aberystwyth College, has suggested that the species may be the result of a mutation in the direction of intensified pigmentation, the spots on the leaves as well as the heavier lip-pattern showing in a two-fold way the outcome of some germinal mutation—probably from *O. prætermissa*. The fact that *O. latifolia* itself appears to cross very freely is also somewhat in favour of its being a true species. Of course, if it be granted that the forms are due to mutation, the specific rank follows; for we need a name for the segregate. Even if the view be taken that there is extreme mutation, and that the forms are in a state of "polymorphic mixture," still the mixture is confined to a certain limited range of forms, and we need a name for the fluid aggregate, and we need to describe its chief types, if not for ourselves, then for those who come after us, who will have to note the ultimate outcome of the evolution of the forms. In his article in Journ. Bot., Dec. 1920, Col. Godfery deals with the matter from a different point of view, and perhaps better: see p. 289 (3).

As hitherto generally accepted, the characters by which *O. latifolia* may be roughly distinguished from other forms are as follows:—The sepals are erect as in *O. incarnata*, *purpurella*, and *prætermissa*—

often quite erect, sometimes less so, but never weak and drooping, as in *O. maculata*. The spur, though variable, is stouter than in *O. maculata*, and usually, though by no means always, less so than in the others. The bracts are very variable, the stem more or less hollow. The leaves are broadest in the middle, often very broad and luxuriant, heavily keeled or nearly flat, nearly always spotted, lightly or heavily, or covered with handsome ringed spots. The most typical lip is much broader than long,. with well-rounded side-lobes, which are hardly crenulate, the centre-lobe distinct, very variable in size, not much or at all exceeding the side-lobes, usually with a blunt and often rounded tip. The lip-pattern is usually a well-defined scheme of broken lines and spots, with spots outside the main lines or not. Sometimes the lines are very heavy and unbroken. The lip is slightly incurved, like a shallow saucer. The throat, where the spur opens into the lip, is much broader than in *O. maculata*. The colour varies considerably, from pale lilac, with darker markings, to very dark purple. Once we saw a fine, semi-transparent white specimen.

The forms known to us can easily be arranged in four main groups with two sub-groups.

Group A. Probably the most numerous and widely-distributed form has flowers with more or less *pale* lilac lips, regular, well-rounded side-lobes, a very small, rounded centre-lobe, the whole lip slightly incurved, saucer-wise, and the pattern of strongly-marked lines of darker purple, more or less broken, but often unbroken. The whole plant is about 2·5 to 4 dm. in height. The leaves are generally broad and spotted, blotched or ringed. The spur is of variable thickness, often rather slender, though not so slender as that of *O. maculata*.

Sub-group *a*. In the same locality at Aberystwyth in which the main type of *O. purpurella* is found, there is a group of very slender plants, 18 to 24 cm. in height, with flower-spikes 3 to 5·5 cm. long, whose flowers are pale and marked as in group A, and are fully as large, the lip being 10 to 12 mm. wide by 6 to 9 mm. long. The form is noticeable on account of its distinct and very slender habit. At a distance it might pass for a small specimen of *O. ericetorum*. It is growing in a field where there are many tall plants of *O. ericetorum*, so that there is nothing in the situation to give rise to the slightness of the form. We have called it the "heath" form of *O. latifolia*. It is characterized by its stiff neat appearance, waxy flowers, short bracts, and rather narrow leaves. At one time we supposed that this was the same as a plant referred to in the Winchester Reports as "down" *latifolia*: at Winchester it grows on the dry downs. Having now seen some complete specimens, by the kindness of Mr. McKechnie, we find that they belong in general habit to the broad-leaved group A, only being somewhat smaller owing to their dry habitat. On the downs at Winchester they grow with *O. Fuchsii*, which in general habit they there resemble, so much so that Mr. McKechnie suggests that *O. latifolia* is nothing but a luxuriant marsh form of *O. Fuchsii*. No such theory would be suggested by the plant-groups known to us, where *O. Fuchsii*, in damp situations, is tall and slender, quite unlike *O. latifolia*, which in general habit is much nearer to *O. prætermissa* or to *O. ericetorum*, according to its type. The "heath" form at Aberystwyth appears to cross readily with other forms, including *O. purpurella*. Reichenbach (Icones Fl. Germ. t. 403) gives a form of *O. latifolia* which the author includes in "latifoliæ veræ": it suggests a very similar plant.

A single flower of this form is given in Journ. Bot. 1920, pl. 556, fig. 13. It may also stand as a representative of group A generally. A flower of the hybrid with *O. purpurella* is also given in fig. 11. The specimens were not specially selected, but a comparison of this flower with those of figs. 13 and 9 or 10 will show at a glance the intermediate type.

Group B. The chief difference between the plants of groups A and B is in the darker colour of the flowers and the less conspicuous pattern of the lip which is the necessary result. Apart from the spotted leaves, plants of this group often strongly resemble specimens of *O. prætermissa*. The difference would be in the stronger-lined pattern of the lip, its thicker texture, and slightly incurved shape. Usually *O. prætermissa* has a lip-pattern of fine spots and an almost flat lip of thin texture—besides the presence of the unspotted leaves. The plants are of about the same size as those of group A. The leaves are usually broad, but there is great variation, and occasionally they are very narrow. *O. prætermissa* v. *pulchella* has heavy lip-markings as a rule, but not arranged in regular loops, as in *O. latifolia*.

Sub-group *b*. We think it advisable to refer to a separate sub-group a set of plants growing at Borth, which have very dark purple flowers, heavy lip-pattern, and stout spurs. The leaves are dark green and rather rigid. As we have noted above, this set of plants is growing out of any connection with *O. prætermissa*, unless it formerly occurred there and died out. *O. ericetorum* is found on the spot, and a mile away, across a wide tidal drain, *O. incarnata*. A lip of this type is given in Journ. Bot. pl. 556, fig. 14. and it may also stand as a representative of group B generally.

Group C. In size and habit of flower this group resembles groups A and B, though the tendency is to a very large size. The colour is that of pale *O. ericetorum*, and generally suggests one or other of the types of Spotted Orchis. The size of the lip in some cases is very large indeed, 13 mm. wide by 8 or 9 mm. long. The lined lip-pattern is slighter, and there are more spots, often very small and almost covering the lip. The difference between these forms and *O. ericetorum* is in the evenly-rounded side-lobes, stouter spur, and more upright sepals. This form will be very near to *O. Braunii* (*O. maculata superba*)—in fact, nothing but experiment could finally decide between them. We have usually found these forms growing in the neighbourhood of the darker ones, but in much smaller numbers. A lip of this type is given in Journ. Bot. pl. 556, fig. 15. In some cases even, the lip is crenulate, much as in *O. ericetorum*.

In this connection it may be useful to call attention to the fact that *O. ericetorum* (as well as *O. Fuchsii*) may grow to a very large size, and in this form may readily be mistaken for a Marsh

Orchis. It is probable that field-botanists pass these forms by without strict examination as *O. latifolia* or hybrids, the more so as they are usually found in marshy places. Obviously the determination of possible hybrids will be much affected by the failure to detect a possible parent. Plants over 5 dm. high are common enough, usually with large and rather flat leaves, solid stems, and typical *O. ericetorum* lips, the spur slender, sepals lax, and centre-lobe of the lip very small. Both forms of *O. maculata* appear to prefer situations neither very moist nor very dry; but we have found large groups of both forms flourishing in wet sphagnum.

Group D. We think a form of which we have specimens from Winchester and the Isle of Wight deserving of special mention. It was familiar to the late Mr. Hunnybun, who drew it, and was inclined to regard it as the best type of *O. latifolia*, owing to the great distinctness of the lip, which did not suggest a hybrid origin. The lip is large and heart-shaped, the centre lobe being scarcely distinguishable. There is a beautifully regular pattern of fine lines, bounded by stronger ones, with a very few dots outside the lines. The spur is very stout, in one example curved a little. The Winchester plant had a few rather large spots on the leaves, the Isle of Wight plant unspotted leaves. These plants might be hybrids of *O. prætermissa* and *O. latifolia*, but it is just as likely that the form is a mutation. The Winchester plant is 38 cm. high, stem stout, with a small cavity, very leafy, the topmost leaf bract-like, the leaves seven in all, four upper ones reaching the basis of the spike, strongly keeled, the longest 14 cm. long, the widest 28 mm. wide, with a few spots and blotches here and there, rather grey-green, shining beneath. Bracts broad and long, exceeding the flowers throughout the whole spike. The spike 6·5 cm. long, the flowers lilac, sepals erect, spur stout, rather short, the lip almost perfectly heart-shaped, the centre-lobe hardly apparent, and pattern of slight but well-marked lines and a few dots, the whole lip flat, side-lobes not crenulate. The lip of this type is shown in Journ. Bot. pl. 556, fig. 16. It is of the Isle of Wight plant.

No doubt *O. latifolia* is intermediate in many characters between *O. prætermissa* and *purpurella* on the one side and *O. maculata* on the other. A study of the figures in the Plate referred to brings this out quite plainly. It does not necessarily follow that all the forms are hybrids. In many groups of living organisms, species which are never questioned as valid arrange themselves in a regular series of gradations between extreme forms. In spite of arguments to the contrary, the heavy ringed spots of *O. latifolia* do not suggest to us dilution, but rather intensification. They are very different from the faint stains that are often found in manifest hybrids. Nor does the characteristic line-pattern of the lip and its regular cup-like shape suggest a combination of other types, but an independent variation. At any rate, we wish to urge these considerations pending the carrying out of experimental crossings, made and tested in accordance with known Mendelian laws.

By way of summary, we may say that the view which our present knowledge suggests to us is that *O. latifolia* is a true species, and that a truly typical specimen of it cannot be confounded with any other species or with first-generation hybrids; but that it is extremely variable—some of the forms resembling no other species, some verging more towards *O. prætermissa* and some towards *O. maculata*, but at the same time not in any sense identical with these species.

P.S.—Since the above article was completed, Dr. Druce has published (B. E. C. Report, 1919, p. 908) a long and interesting note, in which he combats, as we think quite successfully, Mr. Rolfe's contention that *O. prætermissa* is the true *O. latifolia* L. Col. Godfery has also written in this Journal for December last strongly urging the recognition of *O. latifolia* L. as a valid species. We believe that on all the main points we are in accord with Col. Godfery's views with regard to the British plants. In this and his preceding article (Journ. Bot. 1919, 137–142) Godfery has produced ample evidence of the occurrence of a *pure O. latifolia* on the Continent. It is practically certain that British plants precisely similar to these belong to the same species.

THE LICHEN AS TRANSMIGRANT.

By A. H. Church.

Once the probability of the direct progression of the Lichen from the sea has been put on a reasonable basis, from the analysis of its present somewhat secondary and recapitulatory organization, it becomes possible to make a fresh start at the right end of the story; and to build up an account of the sequence of the progression, beginning at the marine inception of the problems concerned, instead of working backward from higher land-flora, as has been so often attempted in dealing with hypotheses of the origin of the earlier vegetation of the world-surface. All other vestigial relations of the Lichen now acquire a new and vital interest. It is to the reproductive phases and the stages of the life-cyle that one must look for further suggestions as to the older marine chapters in the history of the race, now seen to consist more probably of many polyphyletic and parallel lines of early algal organism, similarly faced with the problems of the transmigration at a common horizon. The intrusive and accessory algal 'gonidia' may be largely omitted from consideration. It is on the fungus-component, in its own antecedent algal condition, that interest is specially concentrated; and this is commonly of very normal Ascomycete habit, following again the presentation of what may be referred on general principles to the earliest phase of the Ascomycete progression. For example, consideration of the working-mechanism of the ascus suggests that:—

I. An open exposed hymenium, with asci discharging their content of 8 ascospores in a volley by hydrostatic tension, is presumably the primitive method of spore-distribution in the group[1]; and that it was to this end that the ascus was elaborated in the first place from a unilocular sporangium emitting flagellated zoïds in an aquatic phase[1]. The apothecium with freely exposed hymenium may be so far regarded as older than the perithecium, in which protection of the developing asci becomes more important than the actual discharge of the spores in free air. On the other hand, many lichens present the perithecial condition[2], while the general parallelism of organization between a perithecium and a Floridean cystocarp in biological features of parental protection, as well as of nutrition and ostiolar mechanism of emission for immotile spores, suggests a similar origin in the sea, and Pyrenomycetous Lichens may be equally based on marine prototypes.

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[1] Buller (1909), *Researches on Fungi*, pp. 234, 240.

II. The production of numerous small ascocarps scattered over the general surface, margin, or tips of the soma, is undoubtedly more primitive than the restriction of the soma to one large cup in the manner of *Peziza*, or the enlarged convoluted hymenium of a *Morchella*; and the former method of ascus-distribution—as implying an indefinite number of parasitic sporophyte-stages, following indefinite production of oogonial ramuli—is again carried out much in the manner of the distribution of the cystocarps enclosing similar parasitic diploid generations among the Florideæ. Thus it is evident that the apothecia are commonly associated with end-ramuli of the branching soma; and when, in the limit, the entire shoot-system reduces to a single axis (as in monaxial Angiosperms, or the case of the Cycad from branched arboreal types), the *Peziza*-cup, as also the *Agaric*-model, present the highly specialized limiting case of a sequence of morphological reduction. In their retention of a primitive construction of small scattered apothecia, abundantly produced over a freely branching soma (*Cetraria*, *Usnea*), the fruticose Lichen clearly antedates the more typical saprophytic Ascomycete; though a multi-branched massive soma with countless perithecia still obtains in *Xylaria*.

III. Again, it is among the Lichen-forming Ascomycetes that one finds the most remarkable suggestions of vestigial sexual organs, as oogonial and antheridial ramuli, which with the exception of the Laboulbeniaceæ, alone among Ascomycetes (and it may be said among all Eumycetes) present any definite suggestion as to the possibility of cross-fertilization, as opposed to decadent autogamy. Indications of a mechanism of undoubted spermatogamy, much in the manner of the Florideæ—though very distinct in cytological details of the units—present recognizable examples of parallel progression in these widely divergent phyla; similarly expressing by the closeness of such convergence a condition of response to similar conditions of marine environment (as in reef-pools), and undoubtedly at the same algal horizon.

IV. On the other hand, there is no need to labour the point that, though so curiously parallel, the early Ascomycetes and the Florideæ present no direct connection in essential reproductive stages, any more than they do in their cellular somatic organization. The filamentous construction of the Floridean soma, with its mechanism of primary pit-connections, bears no relation to the mycelium of an Ascomycete.

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[1] Church (1919), *Thalassiophyta*, Bot. Mem. 3, p. 56.

[2] A. Lorrain Smith (1911), *British Lichens*, vol. ii, p. 263. Pyrenodei.

While the Floridean types still in the sea show the unilocular sporangium reduced to an output of 4 tetraspores—as the minimum number following an act of meiosis, and borne on a free-living individual,—the Ascomycetes, transmigrant to the land, still retain what may be fairly regarded as an older condition of 8 ascospores, beyond the meiotic division; and the latter is borne on a parasitic sporophyte-phase. There is no indication that the limiting number 4, so constant among Florideæ, when once established, should be increased to 8 with equal constancy: the claims of subaerial wastage, for example, may augment the output of asci, but are not likely to necessarily affect the established mechanism of spore-production.

While the algal precursors of the Lichen Fungi thus afford a glimpse of an older and now wholly lost race of marine algæ, as well as expressing an older range of the Ascomycete type behind the decadent saprophytic forms—and even suggestions of a wider algal phylum beyond the horizon of the Florideæ,—it becomes of interest to follow the course of what would probably have happened to such a race in passing through the vicissitudes of the transmigration epoch, to attain firstly a holosaprophytic habit, and subsequently a recovery of autotrophy in virtue of the helotism of intrusive algæ, which has undoubtedly proved curiously successful under certain inferior conditions of subaerial environment, in which the plants have no modern competitors. In this respect special interest attaches to the condition described as involving 'intrusive organism' in the older phase of the sea.

Starting from the lofty standpoint of the higher animal, one is apt to ignore the fact that every such individual organism may be preferably regarded as a special formation in the ecological sense, quite as much as an individual entity. Even in health we each carry an elaborate flora and fauna of our own. In the sea, conditions of life are even more complex, owing to the difficulty of finding suitable unoccupied substratum for the attachment of benthic organism as anchored *hormon*. In fact, the inception of free-swimming *nekton* at any point of the animal-series, may be largely regarded as one form of necessary response to this very restriction of available area in such stations. The same applies to the vast amount of epiphytic, epizoic, endophytic, and actively intrusive organism which characterizes the lower forms of plant-life in the sea. Germinating spores, in absence of clean rock, must germinate, it at all, on other organism; and more massive perennial growth-forms may commonly become wholly clothed and buried in a forest of epiphytes to the limit of their hapteron-capacity [1]. Where the organism is of simple plasmatic nature, or is only invested by thin mucilaginous wall-substance, there is nothing to prevent intrusion by such spores—more particularly if possessed of flagellated and englenoid activity—and the consequent establishment of one organism within another; taking the chances of shelter, and food-supply in the form of waste products of the 'host,' but also of diminished light-supply if within a plant, or of speedy digestion if inside an animal. Thus in the densely populated environment of the sea, it may be taken for granted that for benthic organism, anything may grow on anything else; and if the host be penetrable, anything may get inside—in every case with certain inevitable consequences. The general facts of intrusive organism thus afford a view of further possibilities of commensalism or symbiosis, as so far the commonplace of the sea; though appearing more unusual, and hence a phenomenon attracting greater attention, in the case of higher plant-forms and the very specialized vegetation of the land; more particularly as we first become familiar with it in the impoverished versions of northern latitudes. Before emphasizing or exaggerating the unique nature of the Lichen-symbiosis, it may be well to consider the biology of the more general phenomena of 'symbiotic' life in the sea, from which undoubtedly the Lichen Fungi have been at some time derived. Leaving on one side the case of suggested Bacterial symbiosis, as in forms presumably assisting nutrition by the decomposition of celluloses in the alimentary canal of even higher animals, and the effect of similar Bacteria in decomposing the humus-complex in soil, and so aiding the partial saprophytism of all higher land-vegetation—every grade of association is possible, from harmless and casual intrusion to facultative and obligate association, to symbiotic union closed by the digestion of the intruder, to the state of complete helotism with loss of any somatic individuality in the intrusive units, or to a condition of complete dependence in the part of the host. Hence in marine biology the question of intrusive organism plays an important part, and soon attracted the attention of early land-biologists; the possibility of intrusion being based primarily on the opportunity for penetration of the peripheral membranes or tissues of the 'host,' and all such phenomena again being commonly indicated as *symbiosis* in a loose sense. Recognition of green chloroplasts and algal units in many widely distributed and clearly animal forms was unavoidable, as seen conspicuously even in fresh-water organism as green amœbæ, green ciliate Protozoa as *Stentor*, the fresh-water sponge (*Spongilla*), the green *Hydra*, as also in the green marine worm *Convoluta*. The algæ were isolated as *Zoochlorella*[1], and the photosynthetic formation of starch was demonstrated in several cases[2]; the value of such carbohydrate to the host being expressed by keeping green *Spongilla* exposed to light in filtered water for a month, and *Hydra viridis* for five weeks[3]. Similar phenomena are associated with the presence of Brown Flagellates, classed generally as *Zooxanthellæ*, also of widest distribution in the sea. Thus, Brandt (1883)[4] gives a long list of marine organism in which such intrusive 'yellow cells' may be observed; though these do not form starch as a photosynthetic by-product or reserve, including Foraminifera (*Orbitolites, Globigerina*), Radiolaria, Flagellates, Ciliates (*Vorticella*), Sponges, Hydrozoa, Anthozoa, Ctenophora, Echinodermata, Polyzoa, Vermes (*Convoluta, Eunice*), Tunicata and Mollusca, with reference only to intrusive flagellated or otherwise simple protoplasts of an order very comparable with the 'gonidia' of a Lichen. The case of the Arthropod, with more or less chitinous or calcified exoskeleton, and that of the Vertebrate with similar exoskeletal armour, are alone omitted from the list. For example, among Radiolaria, more than 100 species have been described as containing 'yellow cells' or Zooxanthellæ, of the nature of Brown Flagellates (whether of Cryptomonadine or Peridine nature), and such intrusive 'algal' zoïds, invading the animal plasma, lead on to endophytic and parasitic modes of existence. The photosynthetic intruder clearly gains shelter and a quiet medium; and in the case of a holozoic host in which metabolic waste may be predominantly nitrogenous, a definite reason is established for such invasion by algal zoïds, in a medium in which scarcity of ions of combined nitrogen is a limiting factor, as a ready solution of the nitrogen-problem. The mechanism of such intrusion may be readily ascribed to chemotactic action, as opposed to simple mechanical intrusion by germinating zoïds with rhizoid processes, seeking attachment.

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[1] *Cf.* Tide-pool algæ smothered in Diatoms: Yendo (1914), Econ. Proc. Roy. Dub. Soc. p. 105, on the commercial culture of *Laminaria* in Japan, by putting clean rock in the sea at sporing-periods: Börgesen (1908) *Botany of the Faeröes*, p. 758; for list of 25 epiphytes on stems of *Laminaria Cloustoni* (*hyperborea*), with zonation, p. 757.

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[1] Beyerinck (1890), Bot. Zeit. 48, p. 725.

[2] Carter (1875) for *Spongilla*; Ann. Mag. Nat. Hist. p. 187. Brandt (1883), Mitt. Zool. Stat. Naples, p. 229.

[3] Brandt, *loc. cit.* p. 265.

[4] Brandt, *loc. cit.* p. 191. Famintzin (1889), Mem. Acad. St. Petersburg, xxxvi.

As examples of symbiotic association in which photosynthesis is apparently non-essential, may be instanced, even in the Plankton-phase of the sea, cases as that of the autotrophic Silicoflagellate *Distephanus speculum*, occurring in the calymma or outer plasmatic layer of the Radiolarian *Pheodaria* which has no siliceous skeleton of its own. The *Pheodaria* apparently collects living *Distephanus* and utilizes it instead of spicules. Another Radiolarian, *Aulocleptes*, with radial spicules only, utilizes Diatom-frustrules for tangential needles. Free green algal units penetrate the mucilaginous sheath of *Schizonema* Diatoms, giving almost the effect of lichen-gonidia; and just as Fungus parasites (*Mycosphærella*) attack *Pelvetia* and *Ascophyllum*, so Naviculoid Diatoms may be endophytic in the mucilage of the receptacles of the latter. As amœbæ and filamentous Bacteria may live inside the sphere of *Volvox* (Molisch), so a Cryptomonad is described as living inside the sphere of *Phæocystis globosa* (Scherffel). Yellow cells or Zooxanthellæ are described for Peridines as *Pouchetia* and *Polykrikos*; just as in turn Gymnodines may invade Copepod eggs (Dogiel) and the alimentary canal of Copepods as Blastodinia (Chatton). A good example of such simple association is afforded by the Cryptomonad, *C. Schaudinii*, living and multiplying in great profusion in the Milioline Foraminifer *Peneroplis pertusus*[1] of the Mediterranean. The Cryptomonad invader is of much the same size as the monokont gamete of the host, and the former are cleared out of the plasma before gametes are matured. Infection takes place at an early date, and the union suggests a simple case of parasitism. Although the Cryptomonad units each possess a brown lamelliform chloroplast, no special advantage to the host can be suggested when these are inside the calcified test, and Cryptomonads are not known to be dominantly holophytic.

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[1] Winter (1907), Archiv Protist. Kund. x. p. 16.

On the other hand, one of the most perfect examples of animal decadence and dependence on the intruder is afforded by the case of the green worm *Convoluta roscoffensis* [1], in which complete decadence of the metabolic organization of the host follows readily obtained food-supply by the photosynthesis of helot algæ of the type of *Carteria* of the Chlamydomonads [2]. Infection takes place in a larval stage, *via* the mouth, and is obligatory. With the alga growing and dividing, the host ceases to feed, but in absence of the algæ it dwindles out; on the other hand, the algal units are reduced to complete helotism as residual chloroplasts.

In all animal-examples of such commensalism, symbiosis, or dependence, it may be noted once more that there is never any question of 'dual control,' and that there is never the slightest indication of a special somatic factor being introduced as implying a new departure in the somatic organization as a 'consortium.' The expression 'intrusion' covers all the cases. Where there is no mechanical hindrance, anything may invade anything, in the chances of a moving medium; such intrusion being but an extended phase of older processes of 'nutrition' by ingestion at the surface of freely-exposed cytoplasm. Suggestions of special adaptations in more successful plant and animal phyla to keep out such intrusions have been noted, as in the case of the abundant screen-formation of mucilage hairs in many seaweeds: the 'trichocysts' of flagellates (*Pouchetia*, *Polykrikos*) have been freely interpreted from this standpoint. The general organization of higher animals with protective exoskeleton, and internal alimentary canal still exposed to 'infection' at its digestive surface, follows the same principles; and even in the plankton-phase the first inception of the cellulose or chitinous membrane has been regarded as owing its persistence in phylogeny to its value as a secondary utilization of the debris-heap of waste polysaccharides to this end.

Admitting the general facts and wide distribution of such phenomena of intrusion in early marine organism, botanical interest next centres in the manner in which such intrusive photosynthetic units may be utilized as a source of carbohydrate by the more dominant heterotrophic fungus of the Lichen-association; since, though the algal cells may be intrusive in the fungus-soma, they are not as in the preceding animal-forms intrusive in the actual plasma of the host. But even here a broader view is required from the analogy of plant-life as known on the land. Heterotrophy is a phenomenon of significant importance in all massive plant-growths, even in the sea to the special factors of which it owes its inception; in that all tissues beyond the range of penetration of light must necessarily live at the expense of the surface-layers—over a range, that is to say, of rarely more than 100 μ. Light-penetration in the case of subaerial vegetation may be much more effective; but the general fact that heterotrophic fungal tissue should derive soluble sugars (*i. e.* non-colloidal carbohydrate capable of passing polysaccharide membranes in the absence of direct haustorial perforation or plasmic continuity)[1], from full autotrophic algal units, is really at bottom no more remarkable than the commonplace phenomenon observed in the nutrition of non-chlorophyll containing tissues of the more internal parts of higher plants, at the expense of the cortical layer with chlorophyll-content—all such tissues being equally heterotrophic. Heterotrophy is, in fact, one of the most general phenomena in all advanced benthic plant-organism; the tissues need not be in direct plasmic continuity, and yet soluble materials in excess will be taken by tissues with less content—as shown again by the transfer of soluble substances across the junction of a graft with its stock. The ordinary metabolic mechanism of a massive plant is really run on the same general principles. The wonder, if any, is that the Lichen-habit should not be more general than it is; and this opens up a wide problem as to the origin of the organization of the normal land-plant itself with its heterotrophic tissues. Given the opportunity, by a special set of biological factors, there is no reason why such intrusion should not work out a successful *modus vivendi*, and it remains to consider the inception of such conditions.

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[1] Keeble and Gamble (1907), Q. J. M. S. li. 2. Keeble, *Plant-Animals* (1910), p. 123.

[2] Doflein (1916), *Protozoenkunde*, p. 447.

(To be continued.)

MYCOLOGICAL NOTES.—V.

By W. B. Grove, M.A.

(Continued from Journ. Bot. 1920, 251.)

Boydia insculpta (Oud.) Grove, comb. nov.

Sphæria insculpta Fr.? Elench. ii. 95 (1828). Oud. Mat. Myc. ii, in Arch. Néerl. Sci. 1873, viii. 405, pl. 6, f. 9!, and also in Nederl. Kruidk. Arch. ser. 2, i. 184, pl. 5, f. 9 (same figure).

Zignoëlla (?) *insculpta* (Fr.) Sacc. Syll. ii. 225.

Vialæa insculpta (Fr.? Oud.?) Sacc. Bull. Soc. Myc. Fr. 1896, p. 67, pl. 5, f. 10.

Boydia remuliformis A. L. Smith in Trans. Brit. Mycol. Soc. 1919, vi. 151, f. 1.

Cf. also *Duplicaria Empetri* Fckl. Symb. Myc. p. 265, pl. 4, f. 22 (on *Empetrum nigrum*).

In August, 1919, I found a number of the trees in the Holly collection in Kew Gardens to be badly infested with a fungus which had very remarkable and unusual spores. These spores have much the shape of two Indian clubs placed base to base, or rather of the sham Indian clubs used in schools, technically known as "sceptres." On investigation it was concluded that the fungus was possibly what Fries described (*l. c.*) as *Sphæria insculpta*. But further enquiry showed that it had also been met with by other authors and had received various names, as given above.

The spores of all these fungi (except, of course, that of Fries) seem to be absolutely the same, although the external appearances are not all described alike. Since, however, it is difficult to believe that there should occur *on twigs of Holly* several distinct species *having identical spores of the same unique character*, the reasonable conclusion seems to be that the external appearance is dependent upon outside conditions, while the spores remain essentially unchanged.

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[1] Paulson and Hastings (1920), J. L. S. p. 497.

The Kew Gardens specimens may be described as follows:—

Perithecia scattered or aggregated, sometimes two or three being contiguous and immersed in a parenchymatous atro-olivaceous stroma, 300–500 μ diam., globose or lenticular, dull black with a paler centre, immersed in the soft bark only, not sunk at the base in the wood, covered by the shining epidermis and at length piercing it by a small pore. Asci often curved, fusoid-oblong, slightly tapering above, more so below, truncate at the apex, aparaphysate, about 120 × 16 μ, soon deliquescing. Spores intertwined and obliquely distichous or tristichous, elongated, doubly clavate-fusoid, *i. e.* attenuated at each end and narrowed to a filament in the middle, arcuate or flexuose, colourless, filled with guttules and oily protoplasm, 80–100 × 8–9 μ, at length 1-septate in the narrow part.

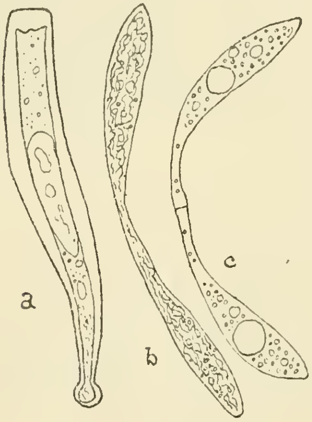

Fig. 1. *Boydia insculpta.*
a, young ascus, ×400; *b*, immature spore; *c*, older spore, ×600.
(From Kew Gardens.)

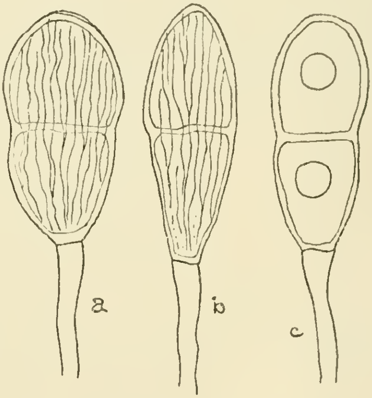

Fig. 2. *Puccinia peucedani-parisiensis.*
a, *b*, spores in air; *c*, spore in water, ×600.
(From near Whitstable.)

On twigs of *Ilex Aquifolium* var. *Hendersonii*, which it appears to kill. Kew Gardens, Aug., Sept. (Fig. 1).

The perithecia have a very thick but soft wall, formed of dark greenish-olivaceous cells, either pseudo-parenchymatous or arranged more or less in parallel chains: the stroma, when present, is of the same character. The epidermis over them is for a long time unbroken and rises like a "boil," as if full of whitish pus, surrounded by a black border. At length the epidermis is pierced by a small pore at the summit of the boil: when several perithecia are contiguous, the pore becomes a slit. The very oily spores may have many or only one large guttule in each loculus and, when mature, they readily break apart at the septum. The compound form seems to be more nearly allied to the Dothideacei than to the Valsei.

The Friesian species is described as growing on decorticated branches of Holly, and having the perithecium semi-immersed, with the upper part deciduous so as to leave the "nucleus" only behind, "nestling in the wood like a *Stictis*." When old and exolete, there remains only a white pit surrounded by a black border. Of course, Fries does not describe (perhaps did not see) the spores.

Oudemans' species seems to have been the same externally, since he does not describe that aspect and refers to Fries without hinting at any doubt, but he adds a description of the asci and spores which shows that they are exactly those of the British specimens. In 1918, Mr. D. A. Boyd discovered the same fungus in Ayrshire, and his specimens were briefly described by Miss A. L. Smith in the *Transactions of the British Mycological Society* (l. c.) as a unique species of a new genus, appropriately named *Boydia* after the discoverer, although she mistakenly supposes it to be a member of the Sphærellaceæ. There cannot be the slightest doubt that both these latter are the same, but the Friesian species, which is dimidiate and sunk at the base in the wood might be different.

It is known, however, that the same fungus may occur, sunk in the wood or immersed only in the soft bark, according to circumstances; *e. g.* this is true of *Phomopsis Diospyri* Grove and of *Phomopsis cinerascens* Trav., as well as of other species. Oftentimes the latter case is found on the younger twigs, and the former on the older and more or less decorticated branches.

In 1896 Saccardo described a fungus with similar spores, but provided with a valsoid stroma, 2 mm. in diameter, although he also says that the perithecia are sometimes rather scattered. For this he formed a new genus *Vialæa.* It is contrary to the principles adopted in Saccardo's *Sylloge* to place such a species in the same genus as others which have discrete perithecia, but it seems to be now admitted that such a separation is not always accurate. For example, it is known with certainty that some species of *Botryodiplodia* (with clustered pycnidia, based upon or immersed in a stroma) are not distinct from certain forms placed in *Diplodia* (with discrete pycnidia and no stroma). That is to say, the same fungus can develop according to its environment in one or the other form. If so, our fungus might well be placed as a form (f. *sparsa*) of Saccardo's. Until this is established without a doubt, however, the genus *Boydia* should be temporarily maintained, but according to the rules the specific name must be *insculpta.* Thus we should have to write now *Vialæa insculpta* and *Boydia insculpta*, although the latter may turn out to be merely *V. insculpta* f. *sparsa.*

Yet this is not quite the whole story. Fuckel, in his *Symbolæ Mycologicæ* (p. 265), described what he considered to be a phacidiaceous fungus, on leaves of *Empetrum nigrum*, and invented for it a new genus *Duplicaria.* The strange thing is that the spores of *Duplicaria Empetri* Fckl., according to the description and drawing (*l. c.*), bear a very close resemblance to those of *Boydia insculpta*, though the asci are said to be accompanied by long filiform paraphyses. Whether these two species are not more closely allied than their present positions would indicate must be left to the future to decide.

PUCCINIA PEUCEDANI-PARISIENSIS (DC.) Lindr.

In Massee's *Mildews, Rusts, and Smuts* (p. 122) this species is listed as British, but the specimens available to me for examination in 1913 did not show the true character, and consequently it was omitted from my *British Rust Fungi*. Towards the end of August last year, Mr. A. T. Rake, of Kew, collected *Peucedanum officinale* near Whitstable, where it is abundant in a certain spot. On his showing me the plants, I pointed out that they bore a small number of sori of a *Puccinia*, and on examination this proved to be the species named above (fig. 2). Afterwards, on referring to Lindroth (Act. Soc. Faun. Flor. Fenn. 1902, xxii. 79), I found that he had received and records a specimen of the same fungus on *P. officinale* from Feversham (misspelt "Tewersham") in Kent.

This very rare parasite differs from its allies, *P. bullata* (Pers.) Wint. and *P. Oreoselini* (Str.) Fckl., in having its teleutospores striped with numerous narrow more or less parallel lines or ridges, which run lengthwise of the spore and occasionally branch or anastomose; rarely these lines or striæ break up into rows of delicate warts. Those of *P. bullata* (which occurs on *Peucedanum palustre* *) are quite smooth; those of *P. Oreoselini* are delicately verruculose, but not lineate.

To observe these characters well, a precaution may be needed. As is well known, faint markings of this kind become difficult to see in water—they must be examined in air. I have before me at the present moment a teleutospore of this *Puccinia* which happens to be divided longitudinally by an air-bubble; on the half in air the stripes are discernible with ease, on the other half nothing is visible but faint granulations which might be put down to the granular protoplasm within.

PHOMOPSIS ABIETINA Grove in Journ. Bot. 1918, p. 293.

Phoma abietina Hartig, Diseases of Trees, 1888, p. 138, figs. 78–9 (Engl. ed.).

Phomopsis pithya Lind, Dan. Fung. 1913, p. 421.

In this Journal (*l. c.*) I suggested that *Phomopsis pithya* Lind was not identical with *Phoma pithya* Sacc. = *Sclerophoma pithya* Died., as Lind asserted, but at that time it was impossible for me (not having seen any satisfactory specimens) to give a decided opinion. Since then I have received some excellent examples of the *Phomopsis* on dead *Pinus silvestris* from Ayrshire, sent by Mr. D. A. Boyd, and also on *Pseudotsuga Douglasii*, kindly communicated by Mrs. Alcock of the Pathological Laboratory at Kew, from Perthshire. These latter are parasitic on small branches of living Douglas

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* The locality which is quoted (*British Rust Fungi*, p. 193) for this fungus should be "Shapwick Bog, Somerset."

Fir, and are exactly what Lind intends: they also agree with what Hartig says and figures so closely that there can be no doubt it is the same fungus which he had before him. The description is as follows:—

Pycnidia densely scattered, convex, erumpent, black, 200–300 μ diam., usually more or less mouthless, sometimes pseudolocellate within; upper part of wall composed of many thick and dark-brown layers. Spores oblong-fusoid, subacute below or at both ends, 5–6 × 1½–2 μ, rarely 1-guttulate; sporophores linear-subulate, 7–10 × 1 μ, crowded, mostly straight, but unequal in length, rising from a thick pale olivaceous brown stratum.

There is a great similarity between this fungus and *Fusicoccum abietinum* Prill. & Del. (Sacc. Syll. x. 241), which = *Dothiorella pithya* Prill. & Del. in Bull. Soc. Myc. Fr. 1890, p. 98, pl. 15, figs. 9–11, and is larger in all respects, the spores especially being 12–14 × 5–5 μ. But it is extremely likely that this is another instance of that dimorphism which is well known in relation to *Phomopsis quercina* v. Höhn. and *Fusicoccum quercinum* Sacc. In the latter case there can be found on twigs and branches of Oak every possible transitional state between the two, the spores of the *Phomopsis* state being 7–10 × 1½–2 μ, and of the extreme *Fusicoccum* state 15–16 × 3–3½ μ. In *Phomopsis abietina* there seems to be a still greater complexity, viz. a *Phomopsis* state, a *Fusicoccum* state, and a *Dothiorella* state; and, after all, it is by no means improbable that the fungus called *Sclerophoma pithya* is nothing but a subsclerotioid state of the same species. Whatever the others may be, the *Phomopsis* state is a decided parasite, doing great harm to numerous species of Coniferæ on the Continent, and may become equally dangerous in the Scottish forests.

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., and A. B. Rendle, F.R.S.

(Continued from Journ. Bot. 1919, p. 314.)

EUPHORBIACEÆ.—III.

Phyllanthus cauliflorus Griseb. A specimen sent by Dr. Britton differs from the specimens from Swartz, which represent all that has hitherto been known of this species, in having inflorescences on the branch as well as on the trunk, thus combining the inflorescence characters of the two species, *P. cauliflorus* Griseb. and *P. axillaris* Muell. Arg. Specimens of this group of species, *P. cauliflorus*, *P. axillaris*, and *P. cladanthus* are much desired. (Fawc. & Rendle, Flor. Jam. iv. 258.)

RUTACEÆ.

"*Rhus?* 1. *Foliis pinnatis ovato-acuminatis subtus villosis, floribus racemosis tetrandris terminatricibus.*" Tab. 8, fig. 3, Patrick Browne, Nat. Hist. Jam. 186. There is a leaf of this plant from Browne in the Linnean Herbarium at the end of the *Rhus* cover, with a reference in Linnæus's hand to Browne's diagnosis (quoted above), but not otherwise determined by Linnæus. The specimen includes no flower or fruit, but from Browne's description and figure of the flower together with the leaf in the herbarium, we have no hesitation in identifying it with *Zanthoxylum flavum* Vahl. (Fawc. & Rendle, Flor. Jam. iv. 173).

ANACARDIACEÆ.

Comocladia troyensis, sp. nov. *Arbor* parva, trunco tenui. *Folia* 2–5 dm. l., foliolis 6–8-jugis, membranaceis, petiolo et rhachi pilosis aut glabrescentibus, infimis ovato-ellipticis quam superiora triplo brevioribus, superioribus 5–10 cm. l. ovato-oblongis aut oblongis, apice acuto aut brevissime acuminato, basi obtusa inæquilaterali, margine undulato denticulato aut subintegro, nervis prominentibus; petiolulo 1–3 mm. l. *Panicula* parce puberula. *Flores* coccinei, subsessiles. *Calycis* lobi semiorbiculares, quam petala breviter ovata duplo breviores.

Hab. Troy, 2500 ft. *Harris*, 9349!

Near *C. jamaicensis* Britton, but distinguished by the leaflets being in fewer pairs, and having an unequal base.

The following is a key to the species from Jamaica so far as known to us:—

Leaflets entire, not undulate, nor toothed.
  Plants glabrous, or more or less hairy.
    Leaflets in 6–8 pairs, upper usually more than 5 cm. l.
      Leaflets with truncate or rounded base. 1. *C. pinnatifolia.*
      Leaflets with cordate base .... 2. *C. cordata.*
    Leaflets in 3–5 pairs, upper usually less than 5 cm. l. .... 3. *C. parvifoliola.*
  Panicle, twigs, and leaves brown-velvety ... 4. *C. velutina.*
Leaflets toothed or undulate.
  Leaflets with large coarse teeth.
    Leaflets in 8–10 pairs, apex acute to shortly acuminate .... 5. *C. Hollickii.*
    Leaflets in about 14 pairs, apex ending in a long slender acumen .... 6. *C. grandidentata.*
  Leaflets with small shallow teeth.
    Leaflets in 10–11 pairs, base subequal ... 7. *C. jamaicensis.*
    Leaflets in 6–8 pairs, base unequal ...... 8. *C. troyensis.*

Note.—Under *C. pinnatifolia* we include provisionally *C. pilosa* Britton and *C. pubescens* Engler, specimens of which we have not seen. The considerable series which we have examined includes glabrous specimens and others with varying degrees of hairiness.

AQUIFOLIACEÆ.

Ilex florifera, sp. nov. *Arbor* usque 40 ped. alta, glabra, ramulis cinereis. *Folia* 6–10 cm. l., 4·5–8 cm. lat., rotundato-elliptica, integra, margine subrevoluta, apice et basi rotundata, coriacea. costa

supra plana aut subcaniculata, subtus prominente, nervis utrinque plus minus prominulis, venis obscuris, petiolis ·7–1 cm. l. *Inflorescentiæ* (fem. tantum cognitæ) in foliorum axillis plurifasciculatæ, 3-pluri-floræ, corymbosæ, pedunculis c. ·5 cm. in fl. usque 1 cm. in fr. *Flores* 4-meri. *Calyx* 1·2–1·5 mm. l., lobis tubo longioribus, transverse subellipticis. *Petala* oblongo-elliptica vel rotundato-elliptica, sublibera, 2·3–2·5 mm. l., 1·5–1·9 mm. lat. *Ovarium* 4-loculare, subovoideum, stigmate capitato. *Drupa* c. 3 mm. l., subglobosa vel pyriformis, pyrenis 4, 3-angulatis, levibus, linea dorsali instructis, c. 2·5 mm. l.

Hab. In fl. & fr. Apr., May; Union Hill, near Moneague, St. Ann, *Britton & Hollick* 2803! Albion Pen, St. Ann, 2000 ft., *Harris*, 12,012!

Near *I. dioica* Maxim., but differs in the more slender twigs, the entire leaves, the many-flowered corymbose female inflorescence, and other marks.

Ilex uniflora, sp. nov. *Frutex* 12 ped. altus, ramulis validis, brunneo-cinereis. *Folia* 9–12 cm. l., 4–7 cm. lat., elliptica interdum ovato-elliptica, subinæquilateralia, apice obtusa, basi rotundata vel obtusa, integra, margine subrevoluta, coriacea, costa nervisque utrinque prominulis, venis obscuris, petiolis c. 1 cm. l. *Inflorescentiæ* (masc. tantum cognitæ) in foliorum axillis plurifasciculatæ, 1-floræ, pedicellis glabris, 5–7 mm. l. *Flores* 5-meri. *Calyx* 1·2–1·5 mm. l., lobis tubo brevi longioribus, ovato-triangularibus, apice obtusis. *Petala* elliptica, sublibera, c. 2·5 mm. l., vix 2 mm. lat. *Stamina* 5, petalis c. duplo breviora. *Pistillodium* subplanum, stylo abortivo præditum.

Hab. In fl. Nov.; Holly Mount, 3000 ft. *Harris*, 12,201!

Near *I. nitida* Maxim., but differs in the parts of the flowers being in 5 s, the male inflorescence 1-flowered, and flowers smaller.

CELASTRACEÆ.

Maytenus microcarpa, sp. nov. *Frutex* 9–10 ped. alt. *Ramuli* grisei lenticellis creberrimis notati. *Folia* 5–10 cm. l., ovato-elliptica brevissime et obtuse subacuminata, coriacea, margine integro subrevoluta. *Flores* 7–8, in axillis foliorum fasciculati; pedicelli tenues floriferi 2·5 mm. l., fructiferi 5 mm. l. *Calycis* lobi transverse elliptici 1 mm. l. *Petala* rotundata 1·5 mm. l. *Capsula* ellipsoidea, subapiculata, brevissime stipitata, 7–9 mm. l.; valvæ intus purpureæ 4–5 mm. lat. *Semina* plano-ellipsoidea, 5·5 mm. l., 3·5 mm. lat., nigra.

Hab. In fl. Dec., Jan.; in fr. May; limestone rocks in woods, Peckham, Clarendon, 2500 ft. *Harris*, 11,054, 12,800!.

Near *M. jamaicensis* Kr. & Urb., but distinguished by the smaller fruit.

Types in Herb. Mus. Brit. & Herb. Jam.

EPIPACTIS VIRIDIFLORA Reichb.

By C. E. Salmon, F.L.S.

During the past summer I have had the opportunity of examining, in the counties of East and West Gloucester (v.c. 33 & 34) and Monmouth (v.c. 35), a large number of living plants of an *Epipactis* which can only be placed under the above. In spite of much variation in stature (18 to 75 cm.) and shape of leaf, yet the structure of the reproductive organs of the flower and the form of the epichile remained constant and pointed to Reichenbach's species.

It was evident at once that the plants, which invariably grew in woodland and were in their prime the latter half of July, could not be placed under either of the two forms, *dunensis* or *vectensis*, on account of their taller growth, more robust habit, larger and broader leaves, longer bracts, and more numerous, larger, and more open flowers. Indeed, from Messrs. Wheldon & Travis's careful description (Journ. Bot. 1913, 343) of the sand-dune plant and from an examination of dried material, it seems that this might rank at least as a good sound *variety* rather than a *forma* as suggested by Messrs. Stephenson. Col. Godfery goes further and says (Journ. Bot. 1919, 38): "I am inclined to think that *dunensis* has gone far on the road towards differentiation as a species." On the other hand, it is quite possible that forma *vectensis* may prove to be a name covering small weak examples of type *viridiflora* itself.

Upon comparing my plants with Col. Godfery's excellent description (*l. c.*) of his var. *leptochila* and with Surrey specimens, I was convinced that these West Country examples should be placed under his plant, though differing from it in a few minor details. He carefully distinguishes his variety from type *viridiflora*, and emphasizes the following points I had particularly noted in the living plants:—The tall robust stems, sometimes clustered (I saw five together in one spot), the ovate (sometimes almost orbicular) lower leaves, and the large open flowers (rivalling those of *violacea*) sometimes faintly tinged with purple. My plants possessed almost invariably a noticeably long lower bract, leaf-like in form. G. F. Hoffmann (Deutsch. Fl. 182, 1804) described his *Serapias viridiflora* as having bracts longer than flowers, and Fl. Dan. v. t. 811 and Dietr. Fl. Boruss. viii. t. 509 show this feature, but not so pronounced as in my examples. In some specimens the sepals were much broader and less acuminate than one would expect in any form of *viridiflora* (c. 14 mm. long by 6 mm. broad); it is possible that these were hybrids with *E. latifolia* which grew with them. The epichiles of the plants examined were fairly uniform in shape and match well f. 2 of t. 555 in this Journal, Sept. 1920; the hunches were two (with occasionally a small median one), more or less smooth in freshly-opened flowers, becoming more rugose as the blossoms aged.

As regards the reproductive organs, a sketch made on the spot of a side view exactly matches the drawing A 1 in Plate 553 (*op. cit.* Feb.); it was clear that the rostellum was, for all practical purposes, useless, as in no case could one extract the pollinia upon the point of a pencil as can be done so readily in the case of *E. latifolia*. Self-fertilisation was a certainty.

Mr. T. A. Stephenson, who kindly examined one of the larger examples, wrote:—"Clearly a big form of *viridiflora*, much stouter and more *latifolia*-like in its general look than any we have had before. The pollen is very overhanging and friable, falling on to the stigma of itself, and the rostellum is visible as a rudiment in the bud only, having vanished in the open flower."

A possible arrangement of the British forms is suggested below:—

E. VIRIDIFLORA Reichb. [not British unless it includes]
  forma *vectensis* T. & T. A. Stephenson in Journ. Bot. 1918, 1. Isle of Wight (v.c. 10).
  var. *dunensis* T. & T. A. Stephenson [as *forma*]. *Op. cit.* 2. Anglesey (v.c. 52); S. Lancashire (v.c. 59); W. Lancashire (v.c. 60).
  var. *leptochila* Godfery in Journ. Bot. 1919, 38. Surrey (v.c. 17); E. Gloucester (v.c. 33); W. Gloucester (v.c. 34); Monmouth (v.c. 35); Shropshire (v.c. 40).

References should be made to the following valuable articles in this Journal:—Messrs. Wheldon & Travis (1913, 343), Messrs. T. & T. A. Stephenson (1918, 1; 1920, 209), and Col. M. J. Godfery (1919, 37 & 80; 1920, 33).

SOME BRISTOL PLANTS.

By Noel Y. Sandwith.

On September 22nd last my mother and I were botanizing with Rev. E. Ellman on Combe Down, near Bath, N. Somerset, when, on passing a field of potatoes, we were attracted by a quantity of a fine *Fumaria* which we had never seen before. The plants were large, with many long diffuse branches and numerous rather lax and few-flowered racemes of large and very beautiful flowers. The sepals were as broad as the corolla tube, the fruit fairly small, with a very inconspicuous neck, the fruiting-pedicels not recurved in any specimens we examined. The colour of the long corolla was a deep lustrous pink, that of the tips being blackish-purple. On submitting a specimen to Mr. C. Bucknall, he could bring it down to nothing but the very rare *F. paradoxa*, hitherto only known on the mainland of Britain in Cornwall, and first described by Mr. Pugsley in his monograph. A few days later we sent a small fresh example to Mr. Pugsley, and he replied that the plant certainly came under his *F. paradoxa*, which he now refers to the Continental *F. Martinii* of Clavaud. It is, of course, unquestionably a colonist in the Bath locality, but the extension of its range and its occurrence in Somerset is of some interest, apart from the facts that all the Fumitories, even the common one, are scarce or unknown about Bristol.

We were also fortunate enough to make two other rather important discoveries for the Bristol district last summer. *Galeopsis speciosa* is very rare in this part of the country, and only a single specimen had been found, years ago, not far from Wells. Last

September we found plenty of beautiful plants in cultivated ground on the Somerset peat-moors between Ashcott Station and Glastonbury. We have constantly seen the species in similar ground and on a similar soil in the black "warp" land of N. Notts, N. Lincs, and S.E. Yorks, often associated with *Erysimum cheiranthoides*, just as it is in this Somerset habitat. If the plant be a colonist—though both it and the *Erysimum* have been claimed as natives of peaty land —it will rank with *Galium Vaillantii* and *Chenopodium ficifolium*, rare plants which are very firmly established on these peat-moors, the former occurring in extraordinary abundance in every piece of cultivated ground between Edington and Ashcott Stations, and the latter having been known there ever since the time of Thomas Clark.

Pinguicula vulgaris has once more turned up on the peat-moors after an interval of several years. One plant was observed by Mr. T. H. Green in July towards the eastern border of the moors, and we saw seven in the same enclosure in September. In another enclosure near by, *Nitella translucens* grows in masses in several pools left by peat-diggers. It was first discovered for the Bristol district and for Somerset by Miss Honor Perrycoste when botanising with us on the peat-moors in June 1919.

The second new Bristol plant to be mentioned is *Sparganium neglectum*, which, curiously enough, has never before been noted in our area, though recorded for both West Gloucester and N. Somerset. Search has occasionally been made, and Mr. White has always anticipated its discovery. We were very interested, therefore, to see it in good condition on October 6th, growing in a pool (an old strontia digging) in a field near Yate Court, W. Glos. Mr. Salmon agrees to the naming, and we have suspicions that the plant also grows on the Somerset side within ten miles of the city. The characters of the fruit are very unlike those of *S. ramosum* and its variety *microcarpum*, but do not tally with those in Mr. Beeby's plate in certain minor points.

Not far from Yate Court, we found last May a typical bush of *Cratægus oxyacanthoides*. This had not been known on the Gloucestershire side of the district until Miss Todd found it this year near Hawkesbury, and Miss Roper has since reported another bush from Wickwar.

BIBLIOGRAPHICAL NOTE.

LXXXIII. The Botany of the 'Herald.'

The Botany of the Voyage of H.M.S. 'Herald' by Berthold Seemann was published during the years 1852–1857, as stated on the title-page, but in the absence of the original wrappers, no information as to the dates of the various parts can be obtained from the book itself. As it contains numerous new species, the dates of publication are of some importance, and the following table has therefore been compiled from data furnished by contemporary periodicals :—

Part 1, pp. 5–56, tt. 1–10, and map of W. Esquimaux-land (1852).—See Gard. Chron. May 1, 1852, p. 278; Kew Journ. Bot. iv. 156 (1852).

Part 2, pp. 57–80, tt. 13–20, and map of Panama (1852).—See Gard. Chron. Aug. 28, 1852, p. 547; Phytologist iv. 680 (1852); Amer. Journ. Sc. xv. 133 (Jan. 1853).

Part 3, pp. 81–120, tt. 21–30 (1853).—See Gard. Chron. Dec. 10, 1853, p. 791; Kew Journ. Bot. v. 408 (1853).

Part 4, pp. 121–160, tt. 31–40 (1853).—See Gard. Chron. April 22, 1854, p. 255; Kew Journ. Bot. vi. 319 (1854); Phytol. v. 201 (1854); Amer. Journ. Sc. xviii. 132 (July 1854).

Part 5, pp. 161–200, tt. 41–50 (1854).—See Gard. Chron. July 29, 1854, p. 487; Kew Journ. Bot. vi. 319 (1854); Amer. Journ. Sc. xviii. 429 (Nov. 1854).

Part 6, pp. 201–253, tt. 51–60 (1854).—See Trans. Linn. Soc. xxi. 342 (1855); Amer. Journ. Sc. xix. 439 (May, 1855).

Parts 7 and 8, pp. 255–320, tt. 61–80 (1856).—See Amer. Journ. Sc. xxiii. 127 (Jan. 1857); Proc. Linn. Soc. 1856–7, p. lv.

Part 9, pp. 321–360, tt. 81–90 (1856).—See Amer. Journ. Sc. xxv. 116 (Jan. 1858); Proc. Linn. Soc. ii. p. lv; Gard. Chron. Feb. 14, 1857, p. 103.

Part 10, pp. 261–483, tt. 91–100, and cancel-leaves 253–4, 279–80, 345–6 and four others (1857).—See Amer. Journ. Sc. xxv. 116 (Jan. 1858); Proc. Linn. Soc. 1857–8, p. lxx; Gard. Chron. Nov. 7, 1857, p. 759.

The date of part 4 is a little uncertain: following Kew Journ. Bot. it is here given as 1853, but A. Gray gave 1854 as the date, and it was not reviewed in the *Gardeners' Chronicle* until April 22, 1854. Another doubtful point is what pages were comprised in parts 4 and 5 respectively. We know that part 4 began at p. 121, and part 5 ended with p. 200, and it is here assumed that each part contained 40 pages, part 4 including pp. 121–160 and part 5 pp. 161–200. On the other hand, Asa Gray stated that part 4 included about half of the *Compositæ*, which suggests that it may have stopped at p. 152.

According to A. Gray and the *Gardeners' Chronicle*, 14 pages (7 leaves) were reprinted to correct errors and give additional information, and were issued with part 10 in 1857. These included pp. 253–4, 279–80, and 345–6; the four remaining leaves have not been traced. Cancel-page 254 is headed "Further Additions and Corrections, June 8, 1857"; cancel-page 280 includes a new species *Tephrosia madrensis* Seem., which appeared on the original page as *Galactia marginalis* Benth.; and Mr. Britten points out that the leaf 345–6 in the Natural History Museum copy is fixed to the remains of one which previously existed. The writer is indebted to his colleague, Mr. S. A. Skan, for some important references, without which the preceding account could not have been completed.

T. A. SPRAGUE.

In his preface to the work, Seemann acknowledges the help of various botanists "whose labours will confer a lasting value upon it however small the merit that may be ultimately assigned to the parts worked up by myself." The names of the authors are attached to their various contributions, but it may be useful to bring them together in one list, with an indication of the regions to which they relate. The list is arranged under the authors' names:—

Churchill Babington—*Lichenes*: Eskimaux-Land, 47–49; Panama, 246–48; Mexico, 344–5; Hongkong, 432.

A. H. R. Grisebach—*Gentianaceæ*: Panama, 169, 170; Mexico, 318–19.

W. H. Harvey—*Algæ*: Eskimaux-Land. 49, 50.

F. Klotzsch—*Euphorbiaceæ*: Panama, 99–106; Mexico, 276–8.

J. Miers—Panama: *Menispermaceæ*, 76–78; *Solanaceæ*, 172–176.

F. A. W. Miquel—Panama: *Artocarpeæ*, 195–197; *Piperaceæ*, 197–200.

W. Mitten—*Hepaticæ*: Panama, 245–6.

W. Munro—Hongkong: *Cyperaceæ*, 422–3; *Gramineæ*, 423–4,

Nees ab Esenbeck—Panama: *Cyperaceæ*, 221–223; *Gramineæ*, 223–225.

H. G. Reichenbach—*Orchideæ*: Panama, 214–5; Hongkong, 417–19.

F. Scheer—*Cacteæ*: Mexico, 285–93.

C. H. Schultz-Bipontinus—*Compositæ*: Mexico. 297–315.

John Smith—*Filices*: Eskimaux-Land, 44; Panama. 226–243; Mexico, 337–343; Hongkong, 425–431. *Lycopodiaceæ*: Panama, 243; Mexico, 343–4; Hongkong, 431. *Marsileaceæ*: Panama, 244; Mexico, 345. *Equisetaceæ*: Panama, 244.

J. Steetz—*Compositæ*: Panama, 139–163; Hongkong, 384–395.

W. Wilson—*Musci*: Eskimaux-Land, 44–46; Panama, 244–5; Mexico, 344; [Hongkong, 432].

In the *Leguminosæ*, *Scrophulariaceæ*, and *Labiatæ* of Panama, Seemann (106, 176, 187) acknowledges the assistance of George Bentham. Wilson's name is not printed in connexion with the Hongkong mosses, but Trimen has added it in MS. in the copy in the Department of Botany. Two species of *Quercus* from Panama (*Q. Seemannii* and *Q. Warcewiczii*) are named and described (pp. 251–2) by F. Liebmann.

The study-set of Seemann's plants is that in the National Herbarium: see Journ. Bot. 1889, 102–5. James Britten.

REVIEWS.

The Cambridge British Flora. By C. E. Moss, D.Sc., M.A., F.L.S., F.R.G.S., Professor of Botany at the University College, Johannesburg, University of South Africa, assisted by Specialists in certain Genera, illustrated from Drawings by E. W. Hunnybun. Vol. III. Portulacaceæ to Fumariaceæ. Folio; paper boards. Pp. xvi, 200, tt. 191. Cambridge University Press. 1920.

A series of complications, largely arising from the late war, is doubtless responsible for the delay in producing this volume—the second in order of appearance—and for the greatly increased price—£6 15*s.* net as against £2 5*s.* net—at which it is issued. These drawbacks may be regarded as inevitable, but they nevertheless militate strongly against the success and usefulness of the work. At this rate of progression, comparatively few of those who subscribed to the first volume can expect to see the last—some indeed have already passed away—and this consideration, coupled with the cost, will, we fear, deter many from embarking on what must prove an expensive enterprise.

The general features of the *Flora* were discussed in our review of the first volume (Journ. Bot. 1914, pp. 131–4), and there is no need to dwell upon these, as the new instalment naturally follows the plan of its predecessor. A fuller acquaintance with the work confirms the impression already conveyed that the help which can be rendered by typography is not adequately realised: for example, in the index (we note with pleasure that there is only one) all the names, whether retained or synonyms, are printed in roman type, although everyone knows the convenience of the usual differentiation by which the latter are printed in italics.

The volume is almost entirely the work of Dr. Moss, who has however been helped in "*Dianthaceæ*"—more usually known as *Caryophyllaceæ*—by Dr. Druce for *Moenchia* and *Cerastium* and by Mr. R. H. Compton for *Lychnis* and allied genera: Dr. Druce is also responsible for *Montia* and Mr. Pugsley for *Fumaria*. The Syndics of the University Press acknowledge Mr. Wilmott's "valuable assistance both in correcting proofs and in dealing with matters which are usually settled by an editor, in the absence from England of Professor Moss." Mr. Wilmott also contributes a prefatory note on the late Mr. Hunnybun, to whose generous presentation of his drawings to the University the inception of the Flora is due: he pays a high tribute to the artist's work, and justifies the "ultimate limitation of the portraiture to a single specimen" as resulting "in a corresponding gain of that permanent truth of observation which was to him the first requirement." As a rule, the drawings are sufficiently characteristic—in many instances they are excellent; sometimes, however, they are less satisfactory: the Chickweed, for example (t. 56), though doubtless an accurate portrait of the specimen Hunnybun had before him, certainly does not portray the plant as we commonly know it. The arrangement of the drawings on the plates is sometimes bad—e. g. *Nuphar*, *Pulsatilla*, and *Montia fontana* var. *lamprosperma*; and we do not understand the black shading in Stitchwort and some allied plants. The cost of the work might have been considerably reduced and its appearance improved if two or three species in genera such as *Alsine*, *Sagina*, and *Arenaria* had been brought together on one plate instead of very inadequately occupying one apiece: the appearance of the mysterious S. "boydi" on a folio page all to itself is comic, even though the "single tuft" be split into six fragments, as if by an explosion. The dissections as a whole are inadequate—an exception occurs in *Fumaria*, due, we understand, to the wise insistence of Mr. Pugsley, who is responsible for at least some of them; it would have been better, we think to have given these as blocks in the text, to which the excellent maps showing distribution form a useful addition.

An adequate criticism of the text could only be undertaken by one with a more thorough knowledge of the plants described than the present writer can claim. The elaborate division and subdivision of species has necessitated the creation of a number of names: it will take us long to become reconciled to the fact that when we read "Compton in Moss Brit. Fl. iii, p. 69," the reference is to the page actually under our eyes, and indicates that the name to which it is appended is here first published: there is presumably some reason for this departure from custom, but we have failed to find it stated. The notes throughout are often of much value and interest, and add greatly to our knowledge.

Turning over the pages, wherein it is pleasant to note the frequency with which this Journal is quoted, we observe that several plants make their first appearance in a British flora: one indeed is altogether new—the small White Water-lily, usually regarded as a variety of *Nymphæa alba*, is raised to specific rank as *N. occidentalis*. Jersey, it will be remembered, is included in the *Flora*; we have thence a remarkable form—"forma *luxurians*"—of *Ficaria*; *Dianthus gallicus* Pers., of which "a single rather large patch" was found "on fixed dunes in St. Ouen's Bay"; and "*Ranunculus aleae*"—a name which looks somewhat less odd when spelt, in accordance with general custom, with a capital letter: it commemorates one Francis Alea, who was attached to the Madrid herbarium and discovered it near the Escorial in 1843: this was first found by Hunnybun in Jersey, where it is "quite a feature in some places in the dunes: the paler tint of the flowers and the more patulous habit enable the botanist to distinguish it at a glance from *R. bulbosus* with which it grows." Several introductions receive the honour of plate and description, some of them we think, on somewhat insufficient grounds—e. g. *Tunica Saxifraga*, found "at the foot of a land-cliff on ground adjoining a public path near the railway station, Tenby: doubtless a garden escape originally and subsequently self-sown."

We note that Dr. Moss does not allow the claims of *Aconitum Napellus* to nativity, but regards it as "a recent escape from cultivation": "it is inconceivable," he says "that such a handsome and conspicuous plant could have been completely overlooked or ignored by all British botanists during the seventeenth and eighteenth centuries and the first part of the nineteenth." There is of course much to be said for this contention, but in speaking of it as a "recent" escape, Dr. Moss overstates his case. A reference to E. B. Suppl. 2731 shows that in 1819 it was found abundantly in Herefordshire, and in 1820 very abundantly on the banks of a stream near Wiveliscombe in Somersetshire—in which county it has all the appearance of nativity—where it extended at intervals for three miles in these localities it must have existed for some considerable period before its discovery. The Steep Holm Peony (*Pæonia mascula* Miller, 1768; *P. corallina* Retz, 1783), which Marshall thought to be native, is regarded as "naturalised": Smith (E. B. 1513), who by the way regarded *Aconitum* as an introduction, thought it had "probably grown there from time immemorial," and mentions that its discoverer in 1805 met two fishermen who "could recollect having gathered its flowers sixty or seventy years ago": it was however not noticed by Banks on his visit in 1773.

We cannot conclude this notice without referring to and endorsing a protest made by Dr. Rendle in his review of the book in *Nature* for Nov. 11, 1920. We had intended to pass the matter by with the remark that we did not accept as accurate the interpretation, worded in a needlessly offensive manner, placed by Dr. Moss on a notice in the Journal; but Dr. Rendle has expressed on general grounds what might have appeared on our part the outcome of a personal grievance. His protest is as follows:—

"It is to be regretted that personal matters should have been introduced into a work of this kind. *The Cambridge British Flora* will, presumably, take rank as a standard work, a presentation of the knowledge and views of eminent British botanists at a period in the history of botany, and to perpetuate the differences of opinion which have arisen on matters of very secondary importance detracts from the dignity which such a work should possess. The syndics of the Cambridge University Press would have been well advised if they had exercised a fatherly censorship on several paragraphs in the introduction to the present volume."

Conifers and their Characteristics. By CHARLES COLTMAN-ROGERS. With Illustrations. Pp. xiii, 333. John Murray. Price 21*s.* net.

THE genera of *Coniferæ*, now about 40 in number, remnants of a very ancient and once more varied group, are not very difficult to discriminate—when, at least, both cone- and leaf-characters are available; nor when growing in a wild state do the small number of species inhabiting any one country present any very great difficulties. The great majority of the 380 species which the Order comprises are natives of temperate climates, so that more than 200 of them are cultivated side by side in our British pinetums, and then the difficulty of distinguishing between species nearly allied to one another, though from different regions, is considerable As Mr. Coltman-Rogers says in his "Prefatory," "it is hardly possible to carry into a friend's collection of growing trees the seven volumes of Elwes and Henry's *Trees*, Mr. Bean's two, Mr. Clinton Baker's, or even the one volume of Veitch's *Manual.*" A pocketable key to the genera and species is, therefore, unquestionably a desideratum among the many who—whether as botanists, as growers, or otherwise—take an interest in conifers. It is, perhaps, hardly possible, even with the aid of a copious glossary, to render such a key practically useful to the non-botanical without the assistance of figures. The general habit of growth can, perhaps, be adequately described in words; and all that is needed in the form of twig, leaf, and cone can be fully illustrated in black-and-white outline-drawings in the text, without that use of colour-printing and loaded paper which makes Graf Silva Tarouca's otherwise excellent *Unsere Freiland Nadelhölzer* so much the reverse of portable.

Mr. Coltman-Rogers has essayed the formation of a key which, he says, he has transcribed in pocket form. In the present volume the tables occupy pp. 263–305; and, apart from the drawback that they are in type far too small for the eyes of many people, they may serve fairly well for the discrimination of the species and varieties when the genus is known. There is, however. no key to the genera, and the characters of the subgenera only appear at the heads of the lists of species and not in subgeneric keys. The author has apparently so great a dislike for the word "genus" that the Subtribe *Callitrinæ* appears with the "Subdivisions or Species" *Callitris* and *Widdringtonia* and the Tribe *Podocarpeæ* with the "Sections" *Podocarpi*, *Prumnopitys*, *Saxegothea*, and *Microcachrys*. There is a good glossary in which, as elsewhere in the book, the author shows a considerable knowledge of Latin etymology; but it is somewhat unfortunate that the two entries "Nut. A seed enclosed within a hard shell," and "Nux Banata. A nut enclosed in a pulpy covering, as a Yew berry" should appear in close juxtaposition; and the definition of "decussate" as "applied to leaves and branchlets arranged in pairs" hardly covers the case of the leaves of *Juniperus*, to which it is commonly applied. The "Identifying Tables" are preceded by 262 pages of gossip more or less concerned with confers. Two pages are devoted to violins and spruce-trees, two to *Conium maculatum* as a method of execution in ancient Greece, and a good deal of space to the short-comings of public school education, the relative knowledge of country life possessed by Virgil and Pliny, etc., etc. In a volume intended for the pocket one may resent the mere waste of space involved in such a discussion of the appropriateness or inappropriateness of a technical term as that which occupies most of p. 103, or even a shorter circumlocution which can say of the stem of a *Sequoia*:—

"In shape it resembles, with its tapering stem, the familiar form of that Dairy Company's milk-can that we all know so well and hear so often, to the disquietude of our system and the disturbance of our nerves, rolled and jangled along the platforms of our island home railway stations."

A page or two might well have been saved by the omission of the entirely superfluous "the" before the names of species, as if they were Irish chieftains of exalted genealogy. When, however, the author writes of *Abies sachalinensis* that in Hokkaido "it is the sole representative of its species," he does not mean what his words strictly imply, that there is but one example on the island, as seems to be the case with *Santalum fernandezianum* on Juan Fernandez; but simply does not know the difference between a species and a genus. It is clear that Mr. Coltman-Rogers loves his trees, and he may himself know them well; but, while it is painful to find a tree-lover writing of Evelyn's "*Sylvia*," it is a more serious defect when obscurity of style makes it difficult to gather the meaning of sentences intended to inform. The following sentence on the name of *Picea Smithiana* is a fair example:—

"As far as the names go the vernacular aliases (*e. g.*, Morinda) of this tree have—with all apologies to Sir E. Smith, first President of the Linnean Society, and after whom it was named—a far more pleasing ring than the name finally bestowed on it by priority of publication, but not given, we mark, by priority of name as bestowed upon it by the natives and European dwellers before the date 1812, when it was described and figured by Dr. Wallich."

The use of initial capitals to all specific names adds to the amateurish appearance of the book, as also do such abbreviations as "Ps. Ts. Doug. var. Colorado" in the alphabetical list of names which does duty as an Index.

A really useful handy guide to hardy conifers has yet to be written.

G. S. Boulger.

BOOK-NOTES, NEWS, ETC.

The journeys by which Reginald Farrer enriched our gardens and greatly extended our knowledge of the flora of Tibet and China have been brought to a close by his death, which occurred during the last of them, on the frontier range between Burma and China, at the early age of 40. An article (accompanied by a portrait) in the *Gardeners' Chronicle* for Nov. 20, summarises his travels, which have been recorded at length by himself in the *Journal of the Royal Horticultural Society*, vol. xlii., and in the *Chronicle* for 1919–20. Farrer, though not strictly speaking a botanist, was in the first rank of collectors: he "sent home the best seed and obtained the best germinations"; he never "succumbed to the fatal temptation to collect a plant simply because it was new: it was enough for him that it was beautiful and not yet in cultivation." Several hundreds of his plants have proved to be new, and many bear his name, though, so far as we are aware, it has not been bestowed upon a genus. On rock-plants and gardens, Farrer was a recognised authority—his book on *The English Rock-Garden*, noticed at length in this Journal for 1919 (pp. 354–357), is a good example of his discursive style, which may perhaps be accounted for by the fact that he was also a novelist of some distinction.

Sir David Ernest Hutchins, whose death was reported from New Zealand at the beginning of December, was one of the ablest and most experienced forest officers in the Empire. Born in 1850, he was educated at Blundell's School, Tiverton, and entered the Indian Forest Service from the Nancy Forest School. After ten years' Indian service, he entered that of South Africa and devoted himself mainly for the next twenty-three years of his life to the study of extra-tropical forestry, reporting on the Transvaal in 1903, Rhodesia in 1904, the slopes of Kenia in 1907 and 1908, British East Africa generally and Cyprus in 1909, West Australia in 1914–15, and New Zealand in 1916, and visiting Mexico to examine the pines suitable for introduction into Rhodesia. Hutchins's reports are always marked by a careful discrimination of species with special reference to their ecology. *Brachylæna Hutchinsii* Hutchinson, a Composite which yields one of the most useful of East African timbers, was dedicated to him as practically its discoverer in 1910, and at the beginning of 1920 he was knighted for his services to the forestry of the Empire.

By the death of ODOARDO BECCARI on the 25th October, at Florence (where he was born on Nov. 17, 1843) the Linnean Society has been deprived of its oldest Foreign Member, who was for many years Director of the Botanic Garden in his native city. His name is associated with a large number of publications, the earliest of which —*Malesia*, extending from 1877 to 1890—is devoted to the plants which he discovered during his travels in the Malay Archipelago and New Guinea in 1865–76. His chief work, however, was among the Palms, on which family he published numerous memoirs, the principal being a monograph of the *Lepidocaryeæ*.

THE *Transactions of the Lincolnshire Naturalists' Union* for 1919 contains a paper by the Rev. E. A. Woodruffe-Peacock on "Seed Dispersal"—a subject to which he has paid much attention. Special reference is made to the dispersal by birds, whose methods of transport are divided into three groups: "I. Internal Seed Carriage, in the crop, in the gizzard, in the alimentary canal: II. External Seed Carriage, in mud, in clay-balls, amid ruffled feathers, by mucosity: III. External Portion of Plant-Carriage, on the backs, round the necks, on the feet." The observations have been made during a long series of years on trees, bushes, and large plants, and contain much information of value and interest.

THE *Transactions of the Botanical Society of Edinburgh* (vol. xxviii. pt. 1) contains an interesting paper by the Hon. W. R. Riddell on the pharmacopeia of *The Vegetable Family Physician*, a 12mo volume of 176 pages published at Boston, Mass., in 1836: the author, Samuel B. Gunnons, was the editor of the *Botanical Journal*, a monthly magazine published at Boston; "he seems to have known considerable (*sic*) about the botany of his district, and most of his descriptions of plants are clear and easily recognisable." Col. H. H. Johnston contributes numerous notes, containing much of critical interest, on the Flora of Orkney, and Dr. Malcolm Wilson describes a new Phomopsis—*P. Pseudotsugæ*—parasitic in the Douglas Fir. The editor has not yet realised that the tops of pages should be employed for conveying useful information, but is content to occupy them by a reiteration of the fact that they belong to the "Transactions of the Botanical Society of Edinburgh."

THE fifty-second volume of the *Transactions of the Devonshire Association* contains a paper by Mr. G. T. Harris on the Fresh-water Algæ of the county, with a survey of what has been done in their investigation since the first list appeared in the *Flora Devoniensis* in 1829. Special notes on some of the more interesting species are given, followed by a list of new records for the county. The Twelfth Report of the Botany Committee in the same volume, edited by Miss C. E. Larter, contains numerous additions to the flora of the districts.

THE appeal on behalf of the Watson Botanical Exchange Club, which was issued in October, has, we are glad to say, proved successful, and the Club, which since its formation in 1885 has done much interesting and useful work, will continue, though it has become necessary to raise the annual subscription to 14*s.* A change in the officers is announced: Mr. S. H. Bickham, who has acted as treasurer for thirteen years, is retiring, and will be succeeded by the present secretary, Mr. George Goode; his place will be taken by Mr. H. Stuart Thompson, who occupied the same position in 1900–1905.

At the meeting of the Linnean Society on December 9, Mr. Lester-Garland exhibited a selection of the plants collected at Darfur by Captain Lynes and remarked on their geographical distribution: we hope to publish in an early issue a paper embodying Mr. Lester-Garland's observations. Dr. Daydon Jackson made an interesting communication on "The Norsemen in Canada in A.D. 1000, with the Plants they collected." He explained that his remarks were limited to the introductory part of a lecture prepared four years previously, which had been postponed delivery. Starting from the paper read by Dr. Frithiof Nansen before the Royal Geographical Society on the 6th November, 1911, he quoted from recent papers by Daniel Bruun and H. P. Steensby in *Meddelelser om Grönland*, vols. xvi., xvii. in 1918, and a slight sketch by Prof. H. O. Juel, in the current volume of the *Svenska Linné-Sällskapets Årskrift*, p. 61. The course followed by the Norsemen was narrated, from their colonies in Greenland across Davis Strait, to the North-east coast of Labrador, southward through Belle Isle Strait to the valley of the St. Lawrence, and the tract of country on its right bank, where vines were found growing, unsown corn, and a tree called "Masur," these being regarded as *Vitis Labrusca* L., *Zizania aquatica* L., and an *Acer.* The reasons why these voyages were not continued were explained as due to the weak colonies at that time in Greenland, the actual starting-point, and the opposition of the natives, termed "Skrællings," who prevented any attempts at settlements in "Vinland"—the Wineland of the sagas of Erik the Red, and of Thorfinn Karlsefni,—the northern part of New Brunswick.

Mr. Martin Nijhoff, of the Hague, has published a *Naamlijst* of the plants published in the *Flora Batava*, with reference to the volume in which each is described. It consists of two parts—the first containing the Latin, the second the "Nederlandsche Namen." In the latter, the principle which often prevails in English books, presupposing that every species must have a vernacular name, is carried to an excess which seems to us absurd; not only is each species so provided, but genera which have no equivalent in Dutch appear here under their Latin names with a Dutch rendering of the trivial—thus "Paxillus, zwartfluweelige."

The first number has been published of *The Flowering Plants of South Africa*, a new quarterly serial edited by Dr. Pole Evans, Director of the Botanical Survey of the Union of South Africa, published in England by Messrs. Lovell Reeve. Each part (15*s.*) will contain ten coloured plates from drawings by Miss K. A. Lansdell; the accompanying letterpress is by Dr. E. Percy Phillips, of the National Herbarium at Pretoria. The first part contains descriptions and figures of three new species—*Arctotis Fosteri* N. E. Br., *Cyrtanthus contractus* N. E. Br., and *Leucadendron Stokoei* Phillips.

THE finding of *Orchis hircina* is, of course, interesting to British botanists, but one would hardly have expected to find the following in the *Times* (Nov. 13):—"Mr. Frank W. Stedman, a botanist, who was associated with the finding of the rare Lizard orchid at a time when it was believed to have become extinct in this country, died suddenly yesterday at Ashford, Kent."

The Journal of the Linnean Society (Botany: vol. xlv. no. 302, Dec. 7) is chiefly occupied by "A Contribution to the Flora of Australia" by Mr. Spencer Moore, in which he discusses two species of *Tribulus* described by Robert Brown, and describes new and rare species from older collections, mostly at the British Museum, and from recent collections by Dr. F. Howard and Mr. J. E. C. Maryon. Many new species and a new genus—*Leptospermopsis*, allied to *Leptospermum*—are described—this and two other novelties are figured, the plates being somewhat unsatisfactorily lettered "Australian Plants." The paper, considering the cost of printing, might have been more economically printed. The number also contains an account of a visit to Kunadiyaparawita Mountains, Ceylon, by Mr. Frederick Lewis, and on variation in the flower of *Jasminum malabaricum*, by Dr. H. H. Mann.

THE *Transactions of the British Mycological Society* for 1919 (published 1 April, 1920) did not reach us for notice. It contains records of the "fungus foray" held at Baslow, Derbyshire, in 1919: Miss Bayliss Elliott continues her "Studies in Discomycetes" and figures and describes two new species—*Phoma conicola* and *Mollisia Populi*; Mr. G. O. Searle contributes an exhaustive study of *Erysiphe Polygoni* in its relation to cultivated Brassiceæ, and there are numerous short papers by Miss Lorrain Smith and others.

THE Department of Public Instruction of New South Wales is issuing a series of publications on *The Australian Flora in Applied Art*, the first instalment of which is devoted to the Waratah (*Telopea speciosissima*). The handsome inflorescence lends itself readily to decorative treatment; the volume contains numerous illustrations, showing its application to a great variety of subjects, ranging from architecture to umbrella-stands. "Its recognition as the leading flower in Applied Art," says Mr. R. T. Baker in his preface, "is a pleasing connecting-link between the æsthetic taste of the autochthonous inhabitants of this Continent and the British race, for the former named it Waratah, signifying the finest in the Australian bush, to which decision one might add, if not the whole botanical world." Some of the designs for tiles and wall-paper are very effective. The so-called "Australian Waratah Legends", which appear as an Appendix under the heading "Literature" are wonderful examples of "English as she is wrote" in Australia.

THANKS to the generous support of our readers, the deficit which threatened to endanger the existence of the Journal has been cleared off, and it will therefore continue, at any rate for the present year. A list of those who have contributed to ensure this result will be found on p. 3 of the wrapper.

TO OUR READERS.

THE Editor begs to acknowledge, with grateful thanks, the cordial response with which the Appeal made in this Journal for November last has been met. The amount received, amounting to £124 16*s.*, is sufficient to cover last year's deficit, which proved greater than was anticipated, and leaves a small balance towards the cost of this year's issue. The expressions of interest and appreciation which accompanied the financial help have been equally gratifying.

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BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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EPIPACTIS LATIFOLIA IN BRITAIN.

(*Epipactis latifolia* All., including *E. media* Fries, as described by Babington.)

By Rev. T. Stephenson, D.D., and T. A. Stephenson, M.Sc.

In this Journal for September 1920 (pp. 209–212) we published a note on the British species of *Epipactis*. The present paper is an attempt to justify the position there taken up as to the forms hitherto generally assigned to *E. latifolia* or *media*. It seems advisable to start with Babington's diagnosis of the two species in his *Manual of British Botany*, and to discuss afterwards the literary questions involved, which, happily, are now resolved with almost complete finality.

The differences between *E. latifolia* and *E. media*, as given by Babington, are that in *latifolia* the leaves are broadly ovate below and ovate-oblong above, while in *media* they are ovate-oblong below and narrow-lanceolate above, grading evenly into bracts: the lip of the flowers in *latifolia* is broader than long, with recurved tip and smooth lip-bosses; in *media* it is longer than broad, the tip not recurved, and the lip-bosses plicate-rugose: in *latifolia* the lowest leaf-sheaths are appressed to the stem; in *media* they are funnel-shaped. These are the chief differences, and if they really were constant, there would be no doubt of the existence of two distinct forms or species. But Dr. Druce (B. E. C. Rep. 1913, p. 337) long since pointed out that no reliance is to be placed in any of the characters thus distinguished, although in his edition of Hayward's *Botanist's Pocket-book*, 1914, *media* still appears, with Linton's *E. atroviridis* as form (*b*), and Druce's *platyphylla* as form (*c*). No doubt Dr. Druce would now delete *media* altogether.

In some years we found *E. latifolia* (*media*) very plentiful in W. Cardiganshire; in fact, its abundance was simply in the inverse proportion to the amount of wood-cutting and roadside-cleaning that went on. We examined many scores of plants, and found that in the configuration of the leaves and flower-lips every possible cross-combination occurred. We found no *viridiflora*, and concluded that all the plants belonged to one very variable species. Some of these variations it may be worth while to describe.

One plant with a stout leafy stem of 2·7 dm. had broad ovate leaves below, very strongly veined, growing longer and more lanceolate above, and ending in an abruptly narrowed, bract-like leaf, 2·5 cm. below the dense spike; petals and sepals very broad, lips much broader than long, with recurved tip, and two pea-like side-bosses scarcely rugose at all. This suits fairly well the description of *latifolia*. Close to it was a taller plant of 6 dm., with similar flowers but leaves regularly graded into the bracts and nearly twice as long, the lowest funnel-shaped, the next ovate-lanceolate, then narrow-lanceolate, grading into bracts. The lowest bract was actually larger than the topmost leaf, being 9 cm. long. Here is a *media* type of leaf, with a *latifolia* type of flower.

Another specimen wholly agreed with the description of *media*, All the leaves were lanceolate and evenly graded, the lip pointed-triangular with plicate-rugose side-bosses; near it was a specimen with long leaves, very long-triangular lip, and nearly smooth side-bosses.

Many specimens agree with Linton's *atroviridis*: they have the narrower, graded leaf-type, and strongly-marked centre-bosses, as well as the side-bosses. These centre-bosses may be broad or narrow, short or long, scarcely exceeding the side-bosses or coming down the whole length of the lip, very distinct from the side-bosses or merged into them, and combined with either the long or the broad lip-type.

Some forms agree with Druce's *platyphylla*. In one case the lower leaves were nearly circular, respectively 8 and 10 cm. in diameter; they gradually merge into narrow, lanceolate leaves, approaching bracts in appearance. The flower has a roughly equilateral lip, with fairly large plicate-rugose lip-bosses and a central ridge. This lip is of a dull pink colour, the leaves very dark green, thick and glossy. Another specimen has the lowest leaf broader than long (5·5 × 5 cm.); in this case the leaves become ovate-lanceolate, merging into huge lower bracts (8·5 × 3 cm., 8·5 × 2·5 cm., and 7·5 × 2 cm.). As in the previous case, there is a very small central boss.

Quite frequently the *latifolia* type of leaf is combined with the *media* type of flower. There are before us four specimens with perfectly ovate leaves throughout, with no graduation into bracts, except a single bract-like leaf in one case. In one of these plants a broadly ovate leaf 6 cm. long starts only 1·2 cm. from the base of the spike and reaches half-way up it. In another a similarly ovate leaf starts 8 cm. below the base of the spike. These all have flowers of a generally *media* type.

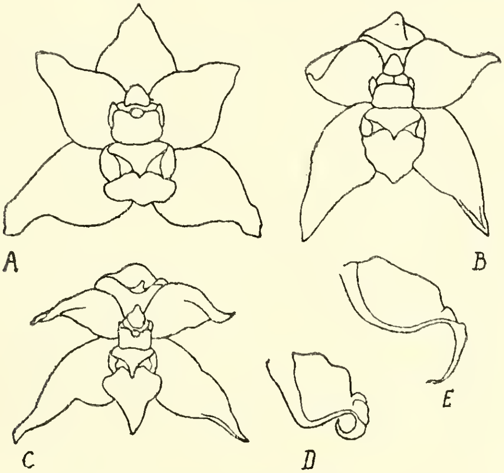
We do not find many cases of lip-bosses which we should call quite smooth, but in one of these the leaves are very narrowly lanceolate, grading perfectly into narrow bracts; in many cases the lip-bosses are almost smooth, and the leaves of *media* type.

In this connection we are rather at a loss to know just what botanists mean by "smooth." We rather think that the epithet is often applied to cases in which the bosses are not markedly knotted and wrinkled, but only a little uneven. We can hardly say that we have seen any plants of any species of *Epipactis* whose lips were devoid of all wrinkles or furrows or convex mouldings of some sort; although some are much less moulded and rugose than others.

Besides single specimens from various localities, we have seen a fair number of plants from Grassington, almost all of which we should set down by their leaf-type to *latifolia*. The lip-bosses varied from nearly smooth to very prominent and lumpy: the centre-boss was absent in some, in others very small; in one it was very distinct, in another there was a strong central ridge. An excellent note on the Grassington forms is given by Dr. F. A. Lees in *The Naturalist* for March 1910 (p. 130).

We have seen a large series of plants from Bath, sent by Mr. Bradley, none of which had very narrow or very evenly-graded leaves: in many the lowest leaf was orbicular, with a minute apex; those above were mostly lanceolate, of a somewhat intermediate type. Some flowers had very small centre-bosses or ridges. None had a large or rugose centre-boss; the side-bosses were of medium size and rugosity, a few almost smooth.

It is thus evident that the amount of variation, when all the forms are reviewed, is very great. The variation of the leaves, both in size and shape, is considerable; in one example the lowest leaf is ovate-lanceolate, 16 cm. long by 7 cm. wide, rapidly narrowing into narrow-lanceolate. In many, as has been said, the lowest leaf is orbicular. Some taper very abruptly, some very evenly. In some cases the leaves are very long in proportion to the stem, in others very short. They may graduate quite evenly into bracts, or the topmost leaf may be very large, and partly or wholly overtop the spike. In this case it may be ovate or long-acuminate. The lower bracts vary enormously. One has been noted 8·5 by 3 cm. They may be very small, about a third longer than the flower. The topmost bracts are always very small, as far as we have seen. The colour of the leaves varies a good deal, being sometimes a deep, glossy green, and passing through various dull shades to yellowish green. The texture also varies, some leaves being tough and strongly ribbed, others much finer. Occasionally we have observed a variegated leaf, the green being broken by oblong yellowish patches, whose shape is determined by the venation.



Epipactis latifolia, lip and flower types.

A. Broad. D. Longitudinal section through centre of lip.
B. Intermediate.
C. Narrow. E. Longitudinal section through centre of lip.

The lips may be roughly divided into three classes: (*a*) much broader than long, with tip recurved, sepals and petals broad; (*b*) long-triangular, the point of the lip not (or not much) recurved, sepals and petals narrower; and (*c*) various intermediates. In the text-figure these types are indicated. Figs. A and D represent the broad type; the details of the lip are shown in Pl. 555. 10; in this case there is a large centre-boss. Figs. C and E represent the narrow type of lip; Pl. 555. 11, gives the details of the same lip; here the bosses merge into one another in a long-triangular moulding. Fig. B gives an intermediate type. Of this lip the details are shown in Pl. 555. 22; here there is a confluent triangular moulding of the lip, with a minute central boss besides. In all three cases the leaves were inclining to a narrow type; but similar lips may be found with all types of leaf.

The character of the lip-bosses varies independently of the shape of the lip; in all cases there are two bosses, and very often three. Sometimes they stand out from the surface of the lip abruptly, but more often the lip is moulded into a fairly smooth triangular swelling, out of which the bosses arise: in that case the central boss is sometimes a mere vertical line or ridge upon the top of this elevation. Where there are only two bosses there may be a deep depression between them; they may stand out very little, with but slight folds, or may be very prominent and much knotted. The centre-boss may be a mere pin's head, or it may be as large or larger than the side-bosses, or it may be long and narrow, sometimes coming down to the point of the lip. And *any* of these characters of lip and boss may be combined with *any* of the characters of the leaves and bracts which have already been described. We have therefore every justification for coming to the conclusion that the distinctions set up in British floras between *E. latifolia* and *E. media* break down completely. All the forms must be assigned to the species *latifolia*, seeing that, as will be easily shown later on, *E. media* must be given up in any case. Purchas (Journ. Bot. 1885, p. 201) argues against *E. media* being counted as a British species, as also does Freyn (B. E. C. Rep. 1897).

At this point a few words may be written in reference to *E. atroviridis*, described as a new species by W. R. Linton in his *Flora of Derbyshire*, p. 270 and plate (1903). The leaves are graduated on the stem, and neither very broad nor very long. The lip has a distinct centre-boss, but a recurved tip, and is broader than long; apparently the character of the centre-boss more than anything else led to Linton's giving specific rank to the form. The Rev. E. F. Linton kindly sent a specimen which he thought was most probably *E. atroviridis*, but could not absolutely certify. The lip of this is given in Journ. Bot. 1920, Pl. 555. fig. 18. It has a long but not prominent centre-boss. The leaves are ovate-acuminate, of an intermediate type. In Cardiganshire a great many plants are to be found with well-marked centre-bosses and of many types of leaf, which might be brought in here; but in view of what has been said about the intermixing of all these characters, it is vain to attempt to maintain the distinctness of this species. Mr. Arthur Bennett in Journ. Bot. 1904, p. 24, questions the specific value of the form, and we entirely agree with his conclusions.

Dr. Druce has described a var. *angustifolia* (of *latifolia*) and var. *platyphylla* (of *media*). To what extent these forms represent constant variations we have no means of deciding. We have found broad and narrow types here and there, mixed with other forms. In B. E. C. Rep. iv. 503 (1916) the narrow-leaved form is reported as present in great quantity, with no other types present. We have not seen anything of the sort in localities known to us.

We may now study in more detail the specimens of lip-bosses figured in pl. 555. First, taking the whole aggregate of species, it will be noted that *E. viridiflora* presents the smoothest type of lip, otherwise there are considerable differences between the three types shown. Var. *dunensis* in fig. 1 has a broad type of lip, with three rather large, confluent bosses, whilst var. *vectensis* (fig. 2) has a long-pointed lip and no centre-boss, and var. *leptochila* (fig. 3) with the same long-pointed form has a very different moulding, and a pair of ears, a feature paralleled in the case of *E. latifolia* in fig. 16. *E. purpurata*, figs. 4 and 7, shows a somewhat heart-shaped lip, with more rugose side-bosses, and a small central boss; the colour-scheme of this species is quite distinct (see *op. cit.* 1920, p. 209).

E. atropurpurea (fig. 8) has by far the most rugose side-bosses; we have never seen a specimen in which this was not so. In the lip figured, there is a strongly rugose centre-boss; in some cases, however, this may be absent. The shape of the lip, in the example figured, is almost semicircular, and this is from a fairly representative plant. Fig. 5 shows a lip with highly rugose side-bosses, prominent centre-boss, and a pointed lip with sides incurved: this is from a Grassington plant which we take to be a hybrid of *E. atropurpurea* and *E. latifolia*. It is certainly not pure *atropurpurea*, and in that case, its intermediate character is very evident from the drawing; we have never seen another example of a thoroughly incurved lip.

Figs. 8–23 and 25 give examples of *E. latifolia* (*media*): of these we may assign figs. 8, 9, 10, 13, 14, 17, 18, and 25 to the "broad" type, figs. 11, 12, and 16 to the "narrow" type, and figs. 15, 19, 20, 21, 22, and 23, to the "intermediate" type, which has already been referred to. Of these the corresponding leaf-schemes were in part already indicated in our former paper.

In the "broad" set, figs. 9 and 25 have broad leaves, fig. 14 narrow ones, and figs. 10, 13, and 18 leaves of intermediate type. The leaves of fig. 17 were not noted.

In the "narrow" set, figs. 11 and 12 had leaves of intermediate type, and fig. 16 very broad leaves. In the "intermediate" set, figs. 19 and 20 had broad leaves, whilst of the intermediates fig. 15 had narrow leaves, and fig. 23 leaves of broad type. Thus we have every sort of mixture of the three types of leaf and lip.

The varieties of the lip-bosses and moulding are very complicated. In figs. 10 and 13 there is a large, shallow centre-boss, in 8 and 21 a small, rugose centre-boss, in 12 and 16 the three bosses are confluent, 16 being strongly rugose. In figs. 9, 17, and 22 there is a minute but strongly-marked centre-boss. In figs. 18, 19, and 20 there is a central ridge rather than a boss. In several other cases there is something of the sort. In figs. 15 and 23 there is rather a central trough than a ridge (*cf.* also fig. 2).

The general moulding of the lip has also to be considered. Thus in figs. 17 and 22 there is not only the distinct, minute centre-boss, but also a raised moulding in the centre, confluent with the side-bosses, giving a generally triangular effect. This is also seen in figs. 11, 12, 15, and 16. In figs. 11, 15, and 22 we have what we suppose would be generally called smooth side-bosses; figs. 8, 12, and 21 show the most rugose types.

It will be seen that the smoothest types are as smooth as *E. viridiflora*, and the most rugose as rough as *E. atropurpurea*, though in the second case very differently wrinkled. In figs. 23 and 25 the side-bosses are only a little rugose, whilst in figs. 10, 13, and 21 they are almost pea-like. In fig. 14 they are the least elevated and figs. 13, 17, and 21 the most elevated. In fig. 16 (*cf.* fig. 3) the lip runs up into ears.

By way of illustrating the distribution of the many types it may be noted that figs. 12, 15, and 17 were growing close together in a wood near Aberystwyth, and with them plants of still other types—one with a very large centre-boss, another with a very small one, and one with a narrow but rugose ridge. There were many differences in the leaf-type.

The colour of the flowers varies considerably. The sepals are usually of a dull green, giving to the plant a dingy appearance. From this they pass to various shades of dull, or sometimes bright red-purple. The figures given by Camus in his monograph of the Orchids of Europe (1908) have the flowers bright red, both for *E. viridiflora* and *E. latifolia*; in Britain such bright colours seldom occur. The lip is of many shades of red-purple or lilac, sometimes white or greenish white: Mr. A. D. Webster speaks of a fine white variety of *E. latifolia*, found in North Wales, of which we have not seen specimens. The amount of light does not seem to make much difference to the tint; we have seen under the same bush, in flower at the same time, a pure green spike next to a bright purple one. We have found purple flowers in deep shade and dull green ones in profusion by the road-side, in quite sunny positions. At Southport the pale green *viridiflora* grows right out in the open, receiving every hour of sunshine.

We trust we have given enough evidence that the distinctions of *E. latifolia* and *E. media*, as mostly given in British floras, entirely break down. All these forms, as also *atroviridis*, must without doubt be assigned to *E. latifolia*.

We have now to summarize the work recently done on the nomenclature of the group, by which it has been conclusively shown that, whatever be the relations of the British forms, *E. media*, both of Fries and Babington, must be given up.

It would appear that Fries founded "*media*" on the characters of plicate-crenate lip-bosses and tapering (not revolute) apex of the lip, whilst Babington emphasized more the narrower, evenly graduated leaves. We have seen that no such differences hold good for British forms.

Fries (*Mantissa altera*, 1839, 55) gives three forms of his species *media*: "(*a*) floribus albis. *Serapias microphylla* Bot. Dan. non Ehrh. *Serapias latifolia γ albens* Wahl. Suec. p. 589. (*b*) floribus viridibus. *Ser. viridiflora* Reich. Ic. f. 1142 sec. Koch. (*c*) floribus roseo-rubris . . . . *E. atrorubens* Reich. Ic. f. 1141." Col. Godfery in this Journal for 1919 (p. 80), suggests that Fries's (*b*) *viridiflora* is really the green form of his (*c*), which is *atrorubens* (*atropurpurea*), about whose identity there is no doubt. Fries rests on Koch for *viridiflora*, and Koch (he thinks) did not distinguish the green-flowered *atropurpurea* from *viridiflora* proper, and considered that they both belonged to *latifolia*. However, if we compare the plates of Reichenbach, whilst 1141 is undoubtedly *atropurpurea*, 1142 shows a plant with smooth ovaries and less rugged lip-bosses. This may be the same as Reich. Ic. Fl. Germ. 487, which is probably *viridiflora* proper.

As to (*a*) *microphylla*, Mr. Rolfe (*Orchid Review*, xxvii. pp. 78 f) thinks that the note " not of Ehrh." is an error, and that this form *is E. microphylla* Ehrh., figured in Fl. Dan. t. 811, as *Helleborine latifolia montana*. It is *not E. microphylla* Sw., as figured by Schulze, Reich. Ic. Fl. Germ. 484, &c: the figure in Fl. Dan. 811 is of a slender plant with broad leaves and a pointed lip, growing in highland woods. This does not look like any form of *atropurpurea*. Thus Fries's "*media*" proves to be a complex of two or three distinct species. In this connection we must plead guilty to a rather loose use of the phrase *nomen nudum* in our previous paper (p. 210).

Turning now to Babington's identification of Fries's *media*, it may be said that if, as Col. Godfery thinks, Fries's (*b*) is the green variety of *atropurpurea*, Babington was wrong in his use of the name; for these plants really belong to his *ovalis*. But if Fries's (*b*) was true *viridiflora*, then Babington was right in his identification, as we shall see immediately, but led us astray by giving a description which did not really apply to the forms. He was simply handing on the confused description of Fries.

The whole situation, as far as the British forms are concerned, has been thoroughly cleared up by the skill and patience of Col. Godfery, in the article in this Journal referred to above. He shows that the plant named by Babington as *E. media* was first diagnosed by him as *E. viridiflora*: specimens recently secured from his original British locality turn out to be true *viridiflora*. Further confusion arose from the fact that the drawing of *E. media* in E. B. S. 2775, was drawn from a specimen of *E. purpurata*, but coloured like *E. latifolia*. It is no wonder that *viridiflora* was submerged, and Col. Godfery is to be congratulated on his elucidation of the problem thus created. Now that we are able to apply the criterion of the different form of the reproductive organs, *viridiflora* can be diagnosed with certainty, that is, in the living state, and many forms hitherto assigned to *media* must be given to that species, and the rest to *latifolia*. Of course, when *viridiflora* has been identified in any district, the possibility of hybrids with other species cannot be quite excluded, in spite of the fact that the former is self-fertilizing; but we have not hitherto heard of any such hybrids. It is certain that there are none amongst the very various forms the description of which has been the chief object of the present paper.

THE LICHEN AS TRANSMIGRANT.

By A. H. Church.

(Concluded from p. 13.)

On tracing back to the sea it begins to be clear that phenomena of intrusion at an unprotected surface are the commonplace of marine biology, otherwise epiphytism is equally prevalent; since in the abundant life of the sea, as in a tropical rain-forest, everything grows on top of or inside anything else available, in the increasing struggle for some sort of substratum. But the possibilities of penetration are limited by the constitution of the limiting membranes of the organism. This is again but a part of the wider problem which gives so many animal races an external membrane of chitin, becoming an impenetrable exoskeleton, while an internal permeable surface is retained as the alimentary chamber or canal for purposes of food-absorption. Though, in the case of plant-forms, the earliest soft mucilaginous membranes of polysaccharide waste may be readily penetrable (as in the case of intrusive green algal cells in *Schizonema* Diatoms), the more resistant polysaccharides of higher plants restrict further penetration, and thus acquire a 'protective' value. Hence, since the provision of a firmer and more coherent and resistant polysaccharide, including a greater percentage of celluloses, follows the evolution of the higher alga in rougher strata of surface-water, so the possibilities of the intrusion of lower algæ become less and less, until its exceptional occurrence occasions remark; just as land-plants under natural conditions are practically immune to bacterial attack, though many become susceptible to mass-infection under cultivation, and so appear as a novelty. Further it becomes evident that intrusion will be less and less a general phenomenon as cell-walls become more efficiently protective (though always open to special cases, as in the attack of definitely parasitic epiphytoid races and specialized endophytes), and will be less and less practicable in higher grades of marine vegetation; again just as higher animals are attacked most readily from the unguarded alimentary canal or lungs. From this it follows that successful utilization of such a means of existence will not occur in the normally autotrophic races of the sea. That is to say, the Lichen-habit was never evolved in the open sea; but must be the product of subaerial and transmigrant conditions. That a few minor forms (cf. *Lichina*) can endure partial submersion does not affect the argument; so can many Angiosperms. *Zostera* and *Posidonia*, for example, live permanently submerged, and in deep water; but no one supposes that they were evolved there originally. The evolution of the Lichen in encouraging and utilizing phenomena of algal intrusion, *en masse*, and not by mere chance 'infection,' is thus based on the possibility of penetration at the surface; and this will become the more possible as the older plant-surface, originally presenting a frontage of photosynthetic units in closest contact, or in palisade-series, begins to lose its essential function, and with it the special attributes given by active growth and division. A deteriorated cortical system prepares the way for successful intrusion. It remains to consider the possibility of the deterioration of the photosynthetic surface-layers of a seaweed-soma of comparatively high grade, equivalent, that is to say, to a type of plant with a reproductive organization as efficient as that of the modern Florideæ.

Only a very slight acquaintance with the somatic mechanism of seaweeds is sufficient to indicate the manner in which this may be done. For example, in an ordinary Fucoid the photosynthetic units, which carry out the constructive metabolism of the plant in immediate association with the external food-solution, constitute but a relatively thin brown film, about 100 μ deep, over the more massive mechanical tissues of the interior; the peripheral more active units being 10–15 μ only. Stripped of these outer layers, the whole plant reduces to a system of hyphal strands, as an interwoven mechanical tissue of 'descending hyphæ,' to all intents and purposes the mycelium of a Fungus-axis. The same effect is more readily produced in a Laminarian (cf. *L. flexicaulis*), if kept in standing water for a day or two; though in such a type the central tissues are less hyphal, and may even present a massive growth of mechanical tissue with annual increments as ring-effects (*L. Cloustoni*). A little consideration shows what happens. The actively metabolic surface-layers, accustomed to the free interchange of gases and food-salts with the external medium, are more sensitive to changes in the environment as they are the more superficial and the more actively synthetic. In standing water, soon deprived of all free oxygen, they die immediately in the dark owing to lack of oxygen for aerobic respiration; and in the light they also soon fail for lack of further supply of the essential food-ions. On the other hand, the more internal tissues, previously wholly heterotrophic at the expense of the surface-layers, and existing with a minimum oxygen-supply only available by diffusion from the periphery, are on a wholly different footing. Conditions that involve rapid death to the autotrophic surface-cells do not necessarily injure the internal mechanical and reserve tissues. This roughly visualizes the origin of the heterotrophic 'Fungus' from residual vegetation of the sea, banked in standing water, or shaded under decaying masses of vegetation. A 'Fungus' is to be regarded, not as a new land-growth, evolved *de novo* by the progressive elaboration of a mere weft of filamentous mycelium [however much some filamentous algæ may have similarly given rise to filamentous phyla of Fungi (cf. *Mucorini*)]; but a higher Fungus of the land is in short a 'skinned seaweed,' implying a more or less elaborated algal growth-form, in which, on the death and decay of the older metabolic and autotrophic surface-layers, the exposed internal heterotrophic tissues continue their heterotrophic (and even conceivably anaerobiotic) existence at the expense of the soluble carbohydrates of the standing and non-aerated medium. The normal progression of heterotrophy in the transmigrant fungus-phyla, following the natural consequences of a residual marine environment of plant-rejectamenta, thus sufficiently accounts for the loss of the cortical and photosynthetic tissues, as also for the destruction of the protective 'cuticle' and tissues previously resisting intrusion. The two things go together, and need no longer excite surprise. The massive organization of a Fungus, with morphological differentiation of centric or dorsiventral axes, and ramuli of different degree, is but the vestigia of an algal soma, adapted to the normal factors of marine biology, and following its seaweed phylogeny in the recapitulatory production of reproductive organs as 'trichome-derivatives,' whether in the form of a confluent 'hymenium' (*Laminaria*; apothecia), or even as immersed and perithecium-like conceptacles (*Fucus* and Floridean cystocarps). Incidentally it now becomes clear why higher Fungi repeat the complex life-cycle and phases of sexual and asexual reproduction characteristic of the higher algal types of the modern sea (*cf.* Florideæ). There can be no doubt that the heterotrophic Fungus-soma continues the heterotrophic region of the older algal somata, without being in any way a production *de novo*, designed to meet the special conditions of a saprophytic existence; just as in an older Plankton-phase the heterotrophic 'animal' arose by continuing the holozoic method of nutrition common to all naked flagellate life, but merely eliminated the autotrophic chloroplasts, or only their autotrophic function, since vestiges were retained as 'eyes' sensitive to the same octave of solar radiation.

Beyond such a stage of continued rather than incipient heterotrophy, the Lichen covers a special biological case, also readily intelligible to those who have seen the films and scums of low-grade green flagellate and coccoid forms which accumulate in any vessel of standing sea-water exposed to the light. While the main series of higher Eumycetes are clearly derivative from stripped seaweeds which emerged from the water to continue existence at the expense of stored carbohydrate of decaying land-vegetation, the Lichen represents the case of similar simple or branched algal somata, remaining denuded of autotrophic tissue in standing pools, and hence soon smothered with a growth of green autotrophic flagellates, now ready to take advantage of the penetrable tissues of the enfeebled hosts, in their demand for a benthic substratum. The heterotrophic hosts, enclosed in a new mantle of photosynthetic units, merely require to continue their heterotrophic metabolism at the expense of the waste carbohydrate and photosynthetic oxygen, in such a medium only available in the vicinity of these autotrophic units. The synthesis is thus effected in terms of (1) a substratum for the flagellate on attaining the benthic habit, and (2) the only possible means of continued life in the light, or even in the dark, for the more massive Fungus-'host.' The former point is of interest, since in the consideration of any possible advantage to the algal constituent of the Lichen, shelter is commonly postulated, or protection from desiccation; the older vital problem of the struggle for substratum being naturally lost sight of in the consideration of subaerial migrants. It is interesting to note, again, that such a hypothesis precludes the possibility of the recovery of a cortical system by the host, which might be expected to follow in such a case as that of *Fucus*, in which an apical cell, though itself largely heterotrophic, might conceivably survive to regenerate a new somatic region by an apical meristem. But apical meristems are only presented in special types among algæ; the primary case being a condition of general intercalary growth and extension throughout the whole mass, or over localized areas [cf. *Enteromorpha* (Chlorophyceæ), *Asperococcus* (Phæophyceæ); *Dilsea, Rhodymenia, Gigartina* (Florideæ)]. From this it may be said to follow that no Lichen is likely to have an apical meristem in the sense of a segmenting apical cell; and as a matter of fact the Lichen-habit is largely confined to algal types of the lowest grade, in which intercalary growth and ramification of the most generalized character still obtain (cf. *Mesogloia* and *Helminthora*-type with *Usnea* and *Cladonia*). The more elaborate somata of the Lichen-series attain a phase with apical growth in the ultimate ramuli of the type of such Florideæ as *Polyides* and *Furcellaria, Chondrus* and *Gigartina*, in which the general presentation of Lichen-form is sufficiently striking in the living condition, to be even more emphasized when subjected to desiccation on drying in the manner of modern subaerial lichens.

Such a working-hypothesis covers much of the fundamental organization of a Lichen-fungus. One now begins to obtain a clear idea, not only of the *locus* of its transition to the heterotrophic condition, in common with associated saprophytic Ascomycete phyla, but of the *mechanism* of the original failure of the photosynthetic tissue, primarily due to the lack of oxygen for respiration over the night-period in standing pools, as a phase of the same problem which was ultimately responsible for driving fish out of the water to become amphibians on the land. From the standing pool above the tide-range, to existence wholly out of the water in damp air, or with the casual supply of the 'region of the splash' and possibilities of atmospheric precipitations of 'fresh water,' is but a small departure. Familiar observation and recorded data as to the existence of even massive algal growths out of the sea, within the region of the splash, afford a general view of such translation from the water to air; in which, again, further adaptations for increasingly drier conditions, to be ultimately expressed by perennation in a state of even practically complete desiccation, follows a natural sequence of xerophytic progression. The existence of seaweeds out of the sea, exposed to damp air, is sufficiently familiar in the ordinary phenomena of the tide-range and the Fuci of the Salt-marsh; the limiting factor being not so much desiccation in the case of subsaturated air, as the ultimate starvation implied in restricted capacity for proteid-synthesis on removal from the food-solution. Photosynthesis of carbohydrate may be increased, and so prove excessive, since this alone is useless for continued growth; but a relatively very small amount of photosynthetic tissue, associated with sufficient chances of obtaining the necessary food-salts, may solve the problem. not only in subsaturated air, but also under drier conditions. Once it is clear that material for proteid-synthesis is of even greater consequence than water-supply, the way is prepared for xerophytic adaptation to economize the latter; but no xeromorphic adaptations are of avail in absence of food-salts. Hence once removed from the sea-water, even the Lichen-association can be but a starved production, and cannot lead to any very great development of the soma. Desiccation may be faced, but not entire lack of food-salts, whether owing to fresh-water environment, or failure to establish adequate absorption from the substratum. In this way the evolutionary history of the Lichen-association which suggests its possibilities, also equally defines its limitations, and at the same time covers the range of progression for all forms following a similar sequence of biological factors. Summarizing the stages briefly, it may be said that:—

(1) Failure of oxygen-supply in standing pools of sea-water was the most readily conceivable cause of the death of the autotrophic surface-tissues of the original sea-weed, thus leaving the thallus penetrable.

(2) Competition for substratum gave the mantle of green intrusive 'gonidia' of the type of *Chlorella*.

(3) The oxygen-problem may be also responsible for the greater success of the associated organisms on leaving the water for subsaturated air; though the cause of the plants being so exposed may be merely the expression of the pools drying up.

(4) The nitrogen-problem still keeps the plants impoverished; as

(5) The water-problem tends to keep them small and restricted to short seasonal periods, thus further delaying the rate of growth. The last again common to all land-vegetation of whatever grade, and theoretically a factor of less importance than is generally admitted in considerations of the progression of Land-Flora.

Ability to withstand the extreme desiccation of wind and hot sun to a condition of brittleness, often popularly regarded as distinctive of the vitality of Lichens, not only from the standpoint of the Fungus-constituent, as from that of the included 'protected' Algæ, is by no means exceptional, or confined to members of this group. Even high-grade Basidiomycetes of the *Polyporus* and *Agaricus* model will similarly endure desiccation in the soma as a whole, as a part of their normal biological equipment; rapidly recovering and even renewing the delicate mechanism of spore-discharge on being wetted. Thus Buller (1909)[1] describes *Polystictus hirsutus* and *Polyporus rigens* renewing somatic growth after being kept air-dry for a year. *Marasmius oreades* was capable of recovery after 6 weeks, and renewed full activity of spore-discharge in a few hours after being wetted. Other species of *Merulius*, *Polystictus*, *Lenzites*, and *Dædalea*, kept dry for 2 years and 6 months, only required about 4 hours' wetting to recover.[2] For marine algæ Börgesen (1908)[2] gives *Hildenbrandtia* (Floridean and encrusting disc-type) grading into lichen-mixtures at 200 ft. above high-water mark on exposed Atlantic coasts. *Enteromorpha intestinalis* flourishes as a transmigrant in fresh-water streams, attaining a length of 6 ft. in running water; yet on exposed cliffs it covers large areas of rock-face bright green where sea-birds congregate (Rockall),[3] and will endure desiccation until it may be powdered. *Enteromorpha* and *Prasiola* (Chlorophyceæ) live abundantly exposed to fog, rain, and spray as the only source of water and food-salts, 40 ft. above the sea at Faeröe; and

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[1] Buller (1909), *Researches on Fungi*, p. 106.

[2] *Loc. cit.*, p. 111, for list of times and species.

[3] Börgesen (1908), *Botany of the Faeroes*, p. 770.

Porphyra umbilicalis (Floridean) at 30 ft. dries so that it crackles when walked over. The desiccation of *Pelvetia* (Phæophycean), almost to brittleness, is sufficiently familiar on sheltered British coasts. Hence endurance of extreme desiccation on a rocky sea-cliff may be presumed to follow normal processes of natural selection in any phylum of Algæ or Fungi. The Lichen-soma is by no means unique in this respect, though it may be more familiar to the collector. Endurance of complete air-dry desiccation may be attained readily in the soma as a whole; just as similar endurance of desiccation becomes the normal condition of the air-borne spore in every group of transmigrant plant-organism.

Such observations again suffice to indicate the possibilities of nutrition by drifted sea-salt which still characterize lichen-growths facing the sea; and no one who has seen the shaggy covering of Lichen on the cliffs facing the Atlantic, can hesitate to believe that this is the primary transmigrant habit of the Lichen-series as a whole. They constituted one of the pioneer races of the older world, on the first rock-surfaces exposed above the retreating sea; and they have held their station to the present time, since no other plant-organism can compete with them in endurance on such a feeble food-supply.

It will be noted that from the present standpoint, the precise nature of the intrusive algæ becomes a matter of relatively very subsidiary importance, so long, that is to say, as it may be of discrete or Protococcoid habit; while, in the case of transmigrant races, a change of helot intruders becomes not only conceivable but probable. Once the lichen-habit is established and becomes obligatory for these special fungus-migrants, it is possible that any readily available algal units may be utilized for the purpose, with little consequent effect on the morphology of the dominant fungus. These generalizations acquire additional interest in view of recent observations by Paulson (J. L. S. (1920), p. 504) on the utilization of forms of *Chlorella* in many common Lichens, which have long passed as symbiotic with *Pleurococcus* (*Cystococcus*), and what may be even in all cases the algal component of *Physcia parietina*, as described in the classical synthesis by Bonnier. The suggested evolution of a 'primitive' Lichen in fresh-water ponds of the present day,[1] or the synthesis of *Physcia* on the green dust of a tree-trunk in one's back garden, may serve to visualize some points of the process, but affords no adequate appreciation of the facts of the evolution of this remarkable race as a whole, as probably the oldest surviving phase of land-vegetation,—and also, in the more alga-like somata of fruticose forms, possibly the least changed of any subærial types from a period beyond the range of stratigraphical geology. It is considerations as these which lend interest to what is otherwise one of the least considered groups in the range of botany. As the Brown Seaweeds, admitted often grudgingly and as a duty by old collectors to the repose of the Seaweed Album, afford the clue to the evolution of the parenchymatous land-plant, so the Lichen undoubtedly affords the best key to the development of all Fungi; since while the latter pass on to the land and fresh-water, the Lichens are nearest the sea from which they emerged, and still retain a more complete expression of the original algal soma, as well as indications of an older phase of sexual reproduction and the double life-cycle.

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[1] Acton (1909), *Annals of Botany*, xxiii. p. 579, '*Botrydina*, a primitive Lichen.'

While the preceding generalizations may suffice to indicate the mechanism of the progression, so far as it concerns the somatic organization of the individual, through successive phases of reduced and heterotrophic saprophytism, to recovered autotrophy by the vicarious agency of intrusive green flagellates of the type of *Zoochlorella*,—it remains to follow the simultaneous progression of the racial mechanism of reproduction, as presented in the process of fertilization and the provision of means of dispersal, as also the adjustment of the meiotic problem in the life-cycle, which may throw additional light on other phases of the problem, as well as confirming the general hypothesis. It should now be sufficiently evident that the phenomenon was eminently polyphyletic; and many seaweed phyla, as the mixed flora of the littoral zone, residual in standing ponds, may have successfully solved the same problem. The fact remains that one Fungus-series, the Ascomycetes, has survived to show it better than any other; although the point is not invalidated that the latter systematic group probably constitutes a wide polyphyletic range of types, and one wholly empirical, since of unknown algal origin and now abruptly isolated.

Botanic Garden, Oxford,
November 21, 1920.

SOME PLANTS FROM JEBEL MARRA, DARFUR.

By L. V. Lester Garland, M.A., F.L.S.

In the early part of last year Captain H. Lynes, R.N., and a companion visited the province of Darfur in order to study the Natural History and collect specimens. Their stay was unfortunately cut short just as they reached the upper zone of the mountainous district which has very seldom been visited by Europeans and is sure to possess features of considerable interest. Captain Lynes started again for Darfur in November, and means to spend a year there. He will return, no doubt, with a large amount of detailed information; but it is perhaps worth while to record at once the plants which he brought back from the high ground, and which he has been kind enough to present to the British Museum of Natural History. For the information contained in the following paragraphs I am entirely indebted to Captain Lynes.

Darfur is a vast plain about 20 °/₀ larger than the combined British Isles, and with a mean altitude of about 2300 feet above sea-level. The highest part lies in the centre, whence it slopes gradually downwards and outwards, with local series of low, rolling hills. The volcanic *massif* of Jebel Marra, which forms the centre of the province, is in extent about fifty miles N. and S. by 20 miles E. and W., and its importance seems to have been much underrated up to the present time. The greater part of it, according to Capt. Lynes's observations, has a mean altitude of 8000 feet, with peaks rising to 10,000 feet or more. No altitudes of anything like the same importance are found nearer than the Tibesti Mountains in the Sahara (600 miles N.W.), the Abyssinian Plateau (700 miles E. by S.), the Great Equatorial Mountains (900 miles S.S.E.), and the Cameroons and Nigerian Mountains (900 miles W. by S.). Jebel Marra thus stands in a position of splendid isolation, and detailed information as to its fauna and flora cannot fail to be of very high interest.

The vegetation of the province as a whole " varies from pure desert in the North to rather rich park-land (Savannah) in the South." The greater part of the area is covered with " typical North Sudan bush and scrub." The low hills are either quite arid, or covered with the same vegetation as the plain. But Jebel Marra is " quite different from anything else in the Province. These are well-marked vegetal zones, and the upper zone, from about 8000 feet upwards contains many temperate plants."

The following list includes only those species which were found in the mountainous district, but a considerable number of plants were also collected on the plains. A fortnight was spent at Kallokitting (alt. 4000 ft.), which Captain Lynes used as his base, and about 10 days on the mountain itself. The list, so far as it goes, indicates the presence of a composite flora in which North Temperate, Mediterranean, Abyssinian, Sudanese, and widespread Tropical types are all represented :—

Adiantum Capillus-Veneris L. 7300 ft. (very widely spread).—*Dryopteris patens* Desv. (Tropics).—*Pteris longifolia* L. 7200 ft. (all warm regions). *P. aquilina* L. (almost cosmopolitan).

Aloe commutata (Tod.) ? 7600 ft.

Ficus salicifolius Vahl. 6000 ft. (Abyssinia and Arabia). *F. populifolia* Vahl. 7200 ft. (Abyssinia and Arabia). *F. palmata* Forsk. 7100 ft. (Trop. Africa, Arabia, India).

Salix Safsaf Forsk. 7250 ft. (Trop. and N. Africa).

Loranthus globuliferus A. Rich. (on Salix). 7250 ft. (Abyssinia).

Polygonum serrulatum L. (widely spread).

Arenaria Schimperi Hochst. 9500 ft.

Ranunculus pinnatus Poir. 4000 ft. (Trop. Africa).

Acacia albida Del. 7300 ft. (N. Africa).—*Indigofera arrecta* Hochst. 7300 ft. (Abyssinia).—*Desmodium Scalpe* DC. 7300 ft. (Trop. Africa and India).

Monsonia senegalensis Guill. & Perr. (Trop. Africa).

Boswellia papyrifera A. Rich. 5000 ft. (Abyssinia).

Polygala abyssinica R. Br. 9500 ft. (Trop. Africa and India).

Rhus villosa L. 6000 to 7000 ft. (Trop. and S. Africa).

Terminalia Brownei Fres. 5200 ft. (Abyssinia).—*Combretum splendens* Engl. Up to 6900 ft.

Epilobium hirsutum L. 7250 ft. (North Temperate).

Blæria spicata Hochst. 9300 ft. (Cameroons and Mts. of E. Africa).

Mæsa lanceolata Forsk. 7250 ft. (Mts. of Trop. Africa).

Olea chrysophylla Lam.? 8000 ft. (Trop. Africa).

Cuscuta planiflora Ten. 9500 ft. (Mediterranean).

Mentha silvestris L. (Europe, N. and W. Asia, N. India, Temp. Africa).—*Otostegia scariosa* Benth. 6000 to 7000 ft. (Abyssinia, Arabia).—*Micromeria biflora* Benth. 6000 to 7000 ft. (Trop. Africa, Arabia, India).—*Lavandula coronopifolia* Poir. 8000 ft. (Egypt, and the East).

Arnebia hispidissima Sieber. 9500 ft. (Trop. Africa, Arabia, N.W. India).

Withania somnifera Dun. 8000 ft. (Tropics of Old World).

Linaria ægyptiaca Dum. forma. 9400 ft. (Egypt and Syria).—*Veronica Anagallis* L. (North Temperate).

Stereospermum Kunthianum Cham. 5200 ft. (Trop. Africa).

Hypoestes Forskalei R. Br. (Abyssinia, Arabia).

Anthospermum pachyrrhizum Hiern. 8000 to 9400 ft. (Trop. Africa).

Campanula Schimperi Vatke. 8000 to 9400 ft. (Abyssinia).

Lobelia sp., Sect. *Hemipogon.* 7300 ft.

Vernonia amygdalina Del. 7250 ft. (Trop. Africa).—*Conyza stricta* Willd. forma. 8000 ft. (Trop. Africa to India).—*Helichrysum abyssinicum* Sch. Bip. 8000 to 9000 ft. (Trop. Africa).—*Geigeria alata* Benth. Common (Trop. Africa).—*Centaurea senegalensis* DC. (Trop. Africa).

HIERACIUM AMPLEXICAULE L.

By J. Cosmo Melvill, D.Sc., F.L.S.

For a very long time this Hawkweed, of isolated position in the genus, has been known to occur on some ancient walls at Oxford, and, since the date of publication of the 3rd Edition of *English Botany* in 1866, where Garrie Barns, Clun, is given as Don's discovery, several localities in various counties have been named for it. Mr. S. T. Dunn, in his *Alien Flora*, mentions it as "thoroughly established in several places in old villages"; and in the last (9th) edition of Babington's *Flora* Hawes and Cleish Castle, Kinross, are noted for its occurrence.

In July 1895, Mr. Henry Hyde, of Manchester, noticed a large growth of this plant on both sides of a bridge crossing the R. Mersey, between Stretford, Lancashire, and Sale, Cheshire, the two counties being divided by the river. Three years afterwards, on July 2nd, 1898, I was conducted to the spot by Mr. Hyde, and found a very luxuriant growth, some specimens having even found a foothold on the masonry of the bridge itself; I at once recognized it as *H. amplexicaule,* having only recently gathered it at Oxford, whence I sent specimens that year to the Botanical Exchange Club (see B. E. C. Report, i. 578, 1898). About ten years ago, I again visited the spot and noted that the plant was thriving and increasing exceedingly. From the parcel of plants collected in 1919, received from the Club, I was interested to find that Mr. R. S. Adamson, of Manchester

University, had visited this locality and sent examples. These had been queried as *H. sciaphilum* Uechtr. var. *amplifolium* Ley, with which I do not consider our plant has any affinity.

While both Boswell (Syme) (E. Bot. ed. 3) and Babington (ed. ix) include our plant, Hooker in the *Students' Flora* relegates it to obscurity, and Mr. F. N. Williams (Prodr. Fl. Brit.) and the Rev. W. R. Linton in *The British Hieracia* omit its mention altogether. There is therefore no consensus of opinion yet among botanists as to its proper status in our Flora.

To my mind it has considerable claim to fuller recognition. It has evidently been naturalized—especially at Oxford—for many years, and has come to stay, and, what is more, to appear from time to time in new localities. There being nothing particularly beautiful about it, save for exuberance of growth, I cannot think that anyone would purposely plant it, as others of the same genus are more attractive and brilliant, e. g. *calenduliflorum* or *chrysanthum* Backh., *villosum* L., or *lanatum* W. K.

I may add that it has long found a place, italicized, in the *London Catalogue*; Nyman (Conspect. Fl. Eur. p. 448) gives Spain, the Pyrenees, Jura, and the Apennines as its chief localities, making no mention of its appearance elsewhere adventitiously.

GLAMORGANSHIRE BRYOPHYTA.

By Eleanora Armitage.

During the botanical excursions in connection with the British Association Meeting at Cardiff last August, I was able to collect some Sphagna which have been kindly named for me by Mr. J. A. Wheldon, who tells me that only one Bog-moss (*Sphagnum obesum*) had been noticed in this county before. I was also able to add a few new records in mosses and hepatics which Mr. H. H. Knight has verified for me. Mr. Knight had worked at Bryophyta in Glamorgan previously, and has now handed me a list of his more recent records which have not appeared in the Census Catalogues, together with a few old ones from the Herbarium of the late Rev. A. Ley. In the following list the moss records are Mr. Knight's unless otherwise stated. The Sphagnum and hepatic records are the writer's; vouchers of these gatherings for v.c. 41 have been deposited in the National Museum of Wales. The Sphagna were collected in two localities: on moorland at Mynydd-y-Glew at about 400 feet (M.), and on swampy moorland at Hirwain Common, 1450–1500 feet, below Craig-y-llyn (H.)—only two forms were common to both places. The other localities are detailed separately.

Sphagnum acutifolium var. *versicolor* f. *venustum* H.; *S. plumulosum* var. *viride* H., var. *versicolor* f. *tenellum* M., var. *cærulescens* M., and a form passing to *ochraceum* M.; *S. amblyphyllum* var. *mesophyllum* f. *sylvaticum* H.; *S. serratum* var. *serrulatum* H.; *S. cuspidatum* var. *submersum* f. *crispatum* H.; *S. molluscum* var. *vulgatum* f. *compactum* H.; *S. inundatum* var. *ovalifolium*

f. *subfalcatum* M., f. *laxifolium* H., M.; *S. auriculatum* var. *ovatum* f. *rufescens* M., subf. *subsimplex* M., var. *variegatum* M., H.; var. *laxifolium* M.; *S. crassicladum* var. *intermedium* f. *ovalifolium* M.; *S. cymbifolium* var. *glaucescens* f. *squarrulosum* H., var. *pallescens* M., var. *flavescens* M.

Catharinea crispa, Glyn Corwg, 1890, *Ley*; *Polytrichum strictum*, R. Perddyn, 1908; *Rhabdoweisia fugax*, Craig-y-llyn, *Ley*; *Dicranella varia*, Llantwit Major, 1908; *Blindia acuta*, R. Perddyn, 1909; *Fissidens osmundoides*, R. Perddyn, 1909; *Rhacomitrium aciculare*, R. Perddyn, 1909; *R. fasciculare*, Craig-y-llyn, 1920, E. A.; *R. canescens*, sandhills, Pennard Castle, 1907, Merthyr Mawr Warren, 1920, E. A.; *Tortula ambigua*, Southerndown, 1908; *T. intermedia*, Porthcawl, 1908; *Barbula Hornschuchiana*, Porthcawl, 1908; *Weisia rupestris*, Resolven Waterfall, 1890, *Ley*, R. Perddyn, 1909; *Zygodon Mougeotii*, R. Perddyn. 1909; *Bryum pendulum*, Porthcawl, 1909; *B. pallens*, Southerndown, 1908; *Thuidium abietinum*, sandhills, Porthcawl, 1908; *Eurhynchium prælongum*, Cum Cathan, 1907; *E. myurum*, Gower, 1907; *Hypnum chrysophyllum*, Southerndown, 1908.

Alicularia scalaris var. *procerior* (*fide* W. Watson), Craig-y-llyn, 1920; *Calypogeia Trichomanis* and *Scapania irrigua*, Hirwain Common, 1920.

REVIEWS.

Henry Nicholas Ellacombe, Hon. Canon of Bristol, Vicar of Bitton and Rural Dean: 1822–1916. *A Memoir, edited by* ARTHUR W. HILL. 8vo, cloth, pp. 318, 14 illustrations. 'Country Life' Offices, 20 Tavistock Street, London, W.C.: 1919. Price 10*s.* 6*d.* net.

"IT has rarely been the fortune of one individual to exert on gardening in this country an influence so wide and beneficent as that wielded by the late Canon Ellacombe of Bitton": thus begins the preface to the interesting and attractive volume which the Assistant Director of Kew Gardens has devoted to his memory.

The volume begins with a sketch of the Ellacombe family and an account of the Canon's father, Henry Thomas Ellacombe (1790–1885), who preceded his son as Vicar of Bitton, near Bristol, and from whom the latter doubtless inherited his horticultural and botanical tastes. H. T. Ellacombe, as his letters preserved at Kew show, maintained an extensive correspondence with the leading botanists and horticulturists of his day: he is commemorated in *Yucca Ellacombei*, figured in Saunders's *Refugium Botanicum* (t. 317) in 1872, from a specimen in the Bitton garden.

Henry Nicholas Ellacombe, the subject of this memoir, was born at Bitton on Feb. 18, 1822, where he died on Feb. 7, 1916. Of his early life little is known, nor at any time could his career have been described as eventful. He went up to Oxford in 1840 and graduated in 1844: at this period the "Oxford Movement" was at its height, and both father and son came under its influence. He was ordained in

1847, and in 1850 succeeded his father: after this his "life was centred almost wholly in Bitton parish, Bitton Church, and in his vicarage and garden." In 1852 Ellacombe married; one of his sons, Dr. Gilbert Ellacombe, has sent from Rhodesia interesting plants to Kew, and is commemorated in *Kalanchoe Ellacombei.* In 1861 he became a member of the Bath Natural History and Antiquarian Field Club, of which in 1894 he was president, in succession to Leonard Blomefield: he contributed various papers to the Club; the first (in 1869) was on "The Common English Names of Plants," a subject that much interested him and which he further developed in *The Plant-Lore of Shakespeare*, first published in 1878. This ran to three editions: the second (1884) contained a useful appendix of names from fifteenth and sixteenth century writers with which Shakespeare might have been familiar. The flowers of early writers always attracted Ellacombe; those of Gower, Chaucer, Spenser, and Milton formed the subject of papers in the *Gardeners' Chronicle* for 1915. The contents of his *In a Gloucestershire Garden* (1895) and *In my Vicarage Garden* (1902), notwithstanding their titles, are miscellaneous in character; the best account of the garden is that by Mr. W. J. Bean in the volume before us, and in the delightful chapter by Miss Ellen Willmott, a frequent visitor to Bitton, headed "Canon Ellacombe and his Flowers." In this she mentions, among those which their owner regarded with especial affection, the little black pansy, which was "brought from Italy by his father in the early part of the nineteenth century; it became a permanent occupant of the garden, and very few visitors left Bitton without a plant of it. The Rev. H. T. Ellacombe had identified it in Van der Gass's (*sic*) picture 'Il Presepio,' circa 1450, now in the Pitti Gallery. The Canon paid a special visit to Florence to see the picture his father had mentioned, and he was greatly pleased to recognize unmistakably the little flower which is now so widely known as the Bitton black pansy." Those who have visited the Sala Hugo Van der Goes will not forget the charming representation of this little flower, which is strewn about at the foot of the vase of exquisitely-drawn flowers in the foreground of the picture.

The connection with Kew, which had been begun by his father, was renewed by the Canon in 1869, and continued throughout his life under three Directors, with each of whom he was on cordial terms. Sir Joseph Hooker dedicated to him the volume of the *Botanical Magazine* for 1881, and various species from the Bitton garden are figured in that periodical—it will be remembered that the editor of the book we are considering is Assistant-Director of the Royal Gardens, and to his personal reminiscences of Ellacombe, dating from 1912, much of its interest is due. Others have also contributed their quota: Miss Ellen Willmott, already cited, gives an attractive study of that admirable composer of madrigals, Robert Lucas de Pearsall (1795–1855), who was closely associated with both the Ellacombes—where, by the way, did he find in "the old Roman Catholic Requiem" the words "Da nobis pacem," which are quoted in his letter as from that source? Reviews of Ellacombe's books come from Mr. D. C. Lathbury and Sir Arthur Hort—the author of the admirable translation of Theophrastus's *Enquiry into Plants*; for this we are indebted to the Canon, who suggested that Sir Arthur should undertake it.

Although Ellacombe was not what is called a letter-writer, his notes, usually very short and connected with his hobby, give a pleasant idea of the man. One of the most interesting is that in which he announces the discovery of the two long-lost volumes of plant-drawings made for the Duchess of Beaufort at the beginning of the eighteenth century and preserved at Badminton; of these very interesting collections a fuller description than that given by Mr. Hill will be found in *The Garden* for August 28, 1920. There are pleasant accounts, mostly from his note-books, of his trips abroad, usually to Switzerland. The longest is that of Piora, above the St. Gothard Pass—a place which Ellacombe was the first to bring into notice; this, with four other papers, including one on Roses, to which he was devoted, is printed at the end of the volume.

The book is attractively produced, and is embellished with numerous portraits and other illustrations: but it has one serious defect—not only is there no index, but the table of contents is of the most meagre description. Such omissions in almost any book are reprehensible enough, but in a volume such as this, abounding as it does in references to plants, places, and persons of interest, it is little short of criminal.

British Plants: Their Biology and Ecology. By J. F. Bevis and H. T. Jeffery. Second edition, revised and enlarged. Methuen, 1920. Pp. xii, 346. Price 7*s.* 6*d.*

This useful compendium of plant-biology has justified its existence and arrived at a second edition, in which "a rather large number of alterations and additions have been made in order to keep pace with the onward march of the subject." It makes a very readable book for those who are anxious to know something more than the names of the plants they find, and serves as a good introduction to more serious botanical works. It is a *multum in parvo*, every biological aspect being touched upon: first, climate and its effect upon vegetation, then the ecological factors, water and its influence—xerophytes, water-plants, and tropophytes—light and heat, then soil and soil-biology. The first part appears to be essentially a condensation of Schimper's well-known work in which most of the important plant relations are touched upon. Some misleading statements need correction: *e.g.* (p. 27) transpiration signifies the evaporation of water from the shoot whether controlled or uncontrolled, epidermal or stomatal. The recent work appearing in the *Journal of Ecology* casting doubt on the significance of the hydathode has been overlooked. What to the writer appears as a serious omission is the neglect of Blackman's theory of limiting factors, which has now been applied to so many aspects of plant-biology, both in respect of water, light, CO_2, and heat, and also in Russell's book to soil-factors. The dependence of the activities of the plant on limitation by *any* of the numerous interactive factors should be made the starting-point of any modern consideration of plant-biology, and it is hoped that the authors will in a future edition give the reader this most important clue to the plant's true relation to its surroundings.

In the second part the relation of varying morphology to the life of the individual plant is considered, the various terms in use being explained and the biological significance of the forms noted. The special biology of the climbing habit, of less usual methods of nutrition (parasites, symbiosis, etc.) and of food storage, each receive a chapter, and pollination and fruiting are dealt with at greater length.

The third part mostly considers the associations of plants and their relation to the habitats in these islands; it is preceded by short chapters on Evolution, the Origin of the British Flora, and the Classification of Plants. An attempt is made to remedy the sketchiness of these by three appendixes on Weissmann's law of Heredity, the Mendelian Theory, and Botanical Provinces, but readers interested in these aspects should supplement the information given. The work necessarily suffers a little from the difference between vastness of the area to be covered and the necessary limitations of publishing. Having written thus, it may seem contradictory to ask for more, but a little more attention given to cryptogams might stimulate the study of these groups by those who possess microscopes.

The indexing is good, and the print and paper very pleasing. Some misprints and mis-spellings occur: e.g., *Sueda*, which appears throughout. The book should certainly stimulate the reader for whom it was intended.

A. J. W.

Studies in Fossil Botany. By D. H. Scott, D.Sc., F.R.S., etc. Third Ed., vol. i. 8vo, pp. 434; 190 figures. 25*s*. net. London, 1920: A. & C. Black.

Each year that passes sees additions to our knowledge of the plants of the past. In reviewing these advances, we may sometimes notice that the palæobotanist has discovered forms which are allied to living genera and which, as in the case of the fossil Osmundaceæ, carry back the history of a familiar group over untold ages. In other cases the plants discovered are of strange types and apparently unrelated to living forms, or, again, the investigator may have unearthed specimens which are synthetic and seem to unite some of the characters of one known group with the possession of features which are regarded as distinguishing some other different class of plant. As with all other types of research, these discoveries are published to the world in very many different journals in diverse countries and languages, and only the few can see them all and form a view of the knowledge which results. Dr. Scott's work gives a magnificent view in its true perspective of the edifice which has resulted from the study of fossil plants. It is an edifice built on a safe and substantial basis of fact; speculations reared like pinnacles on an unsubstantial basis of problematical and badly-preserved specimens are eliminated; just so much detail is added to show the nature of the building and the texture of the work, while the main and usually uncontrovertible features of plant evolution emerge. As in previous editions, the illustrations form a noteworthy feature of the book, and many new and beautiful figures are included in this edition.

Twelve years have elapsed since the publication of the second edition, and during that period several noteworthy advances have been made in our knowledge of the Palæozoic Pteridophyta. Some of them have helped to fill up gaps in the long continued researches on such familiar plants as *Calamites* and *Sphenophyllum*. In other cases work, such as that of Kidston and Gwynne-Vaughan, of Bertrand and of Gordon on the older Ferns, has not only increased the store of knowledge, but has cleared up uncertainties and provided a fund of authentic information, which enables us to reconsider some evolutionary theories maintained in former days without much positive evidence. To those who have not had the opportunity of studying the original papers, the brief sketch given here, with admirable illustration, of the past history of the Osmundaceæ, must prove of considerable interest; as also of that remarkable group of Palæozoic ferns, the Zygopterideæ, with their curious petioles and two- or four-ranked pinnæ which do not seem to have developed the flattened laminæ now characteristic of leaves.

But it is the last and entirely new chapter in the volume to which all botanists will turn with eagerness. Many of us will begin the book by reading first this last chapter; and we may be excused, for it contains an account of the earliest known Devonian land-plants. It is the first full and illustrated summary yet published by an independent expert, of Kidston and Lang's work on those most remarkable genera, *Rhynia*, *Hornea*, and *Asteroxylon*—work which must be regarded as one of the most important contributions yet made towards our knowledge of plant evolution. In recent years some of us have almost despaired of finding any definite evidence of really early and generalized fossil plants. We seemed to have in the Lower Carboniferous and Upper Devonian rocks highly-evolved types of Ferns, Lycopods, and Pteridosperms, nearly as complex as those varied types of Upper Carboniferous age. But now in the Psilophytales we have plants of a very simple type—leafless, rootless, with the simplest of vascular tissue, with the simplest sporangia, and much more like the primitive plants which we may have imagined. And moreover, these forms are not known from blurred impressions or from isolated fragments, but from petrified examples whose preservation is most perfect, whose stems give sections as fine as if cut from a recent plant, displaying such features as the stomata, rhizoids, and mycorhiza. It is almost incredible that the simplicity of these forms should be due to reduction following the adoption of the mycorhizal habit, and we may have to revise our ideas upon the early evolution of plant-structures. Some theories of which little has been recently heard, such as Treub's "protocorm" theory, may once more come into prominence, and Lignier's views on the morphology of stem and leaf will have to be given fresh consideration.

It is interesting to notice that Dr. Scott is favourable to the ideas which Dr. A. H. Church has recently put forward, and it may be that the discoveries of these most ancient plants will awaken a fresh interest in the study of the morphology of the marine algæ of the present day. Perhaps Church's theory provides a clue to the problem of why such generalized plants as the Psilophytales and such highly-specialized forms as the early Pteridosperms seem to be separated by a comparatively short space of Geological time. But whatever may be our opinion of current theories, the present work gives the botanist a ready means of becoming acquainted with the earlier plants which grew upon the earth.

H. H. T.

BOOK-NOTES, NEWS, ETC.

An admirably illustrated monograph of *The Leguminous Plants of Hawaii* (Honolulu, July, 1920) has been provided by Prof. Joseph F. Rock, of the College of Hawaii. Published by the Experiment Station Committee of the Hawaiian Sugar Planters' Association, who are to be congratulated on their encouragement of science, special attention has naturally been paid to the economic species ; but from a botanical standpoint it is thoroughly satisfactory, the descriptions being full and scientific, with a clavis to the longer genera and a full synonymy: the notes on certain groups—*e.g.* the various forms of "Koa"—are of great interest and importance. The book is very well printed and has an excellent index ; its attractiveness is increased by the plates—92 in number; many of them are taken from an earlier work by the same author on *The Ornamental Trees of Hawaii*, and show the whole tree.

The second part of the botanical section of the important work—*Nova Caledonia*—on the scientific researches in New Caledonia and the Loyalty Islands, edited by Fritz Sarasin and Jean Roux and published last year at Berlin and Wiesbaden, contains an enumeration of the Fungi by Miss E. M. Wakefield and numerous contributions on other groups: the phanerogams are undertaken by Messrs. Schinz and Guillemin, who are editors of the section. The page-headings give no information beyond the number of the page; it is strange that this opportunity for conveying useful information should be neglected in a work of this kind.

Science Progress—whose page-headings remain a standard example of neglected opportunities—contains a paper on "The Soya-Bean Problem," by Dorothy M. Atkins, B.Sc., in which the economic value of *Glycine hispida* is set forth and its cultivation described. "Experiments in some parts of the British Empire show that local conditions are favourable" to its cultivation, but no "serious attempt to start Soya-bean culture on an economic basis has been made." Nevertheless, Miss Atkins hopes (in italics) "*that we shall continue to encourage this promising crop, so that we may avoid repeating the history of our belated support of the sugar-beet*": presumably the "problem" is connected with the cultivation. Dr. Salisbury contributes the usual summary of recent advance in Botany, which would be more useful if the month in which papers appear were named. There is still room for improvement in the proof-reading, and "Spencer le More" is an odd rendering of the name of our valued contributor.

The Imperial Bureau of Mycology, recently established at Kew, "is the outcome of a proposal adopted by the Imperial War Conference in 1918 that a central organization should be established for the encouragement and co-ordination of work throughout the Empire on the diseases of plants, caused by fungi, in relation to agriculture." The committee of management consists of the leading biologists of the country, of whom a list is given in the *Gardeners' Chronicle* for Jan. 1, from which the above information is taken. The Director is Dr. E. J. Butler, formerly Cryptogamic Botanist to the Indian Government, to which in May last year he became Agricultural Adviser.

At a time like the present, when there is so much to make up in the way of important publications which were delayed by the War, while the hindrances presented by the cost of printing show little prospect of removal, the fourth volume of the *Recueil de l'Institut Botanique Léo Errera* issued by the University of Brussels seems to demand a protest. The volume contains nearly 700 pages and costs 50 francs; it consists entirely of reprints of papers, most of them of no special importance and some already obsolete, contributed by Errera and other authors to various journals at dates ranging from 1886 to 1899. No reason for its production is given, and in default of such explanation its publication seems unnecessary.

Mr. Oakes Ames has published a handsome volume, beautifully printed and admirably illustrated, a sixth fascicle of his *Illustrations and Studies of the Orchidaceæ* (Boston, Merrymount Press). It contains an account of "the Orchids of Mount Kinabalu (Borneo)," by Charles Schweinfurth and Oakes Ames; the latter also gives a continuation of his "Notes on Philippine Orchids." A new genus, *Philippinæa* Schlecter and Ames, "the only endemic orchid genus of the Philippine Islands," is established for the plant previously described as *Adenostylis Wenzelii.*

In *Notes from the Royal Botanic Gardens, Edinburgh* (no. lxi; dated Sept. 1920), Professor Bayley Balfour continues to describe new species of *Rhododendron*, mostly from China, whence the supply of novelties seems inexhaustible; seventy species are here named and described. Of *Primula*, which in the way of novelties runs *Rhododendron* close, Prof. Balfour describes from the same regions fifty-five novelties, with three of the allied genus *Omphalogramma.*

The *Kew Bulletin* issued in December (1920, no. 10) contains a paper on the Balsams of Chitral and the Kachin Hills by the late Major Toppin (1878–1917), arranged by Mr. S. T. Dunn from the MSS. and drawings which were bequeathed to Kew. Many new species are described and figured from drawings by Major Toppin and Sir Joseph Hooker, whose notes on the collections are incorporated in the paper. The number also includes continuations of the "Diagnoses Africanæ" and "Decades Kewenses."

We regret to record the death of the Rev. Canon H. W. Lett, which occurred at Aghaderg, Co. Down, of which place he had been rector since 1886, in December last, and of Mr. William Whitwell, of whom notices will appear later.

The *Journal of Genetics* for October contains an interesting and important paper on the Bonavist Bean (*Dolichos Lablab*) by Dr. S. C. Harland.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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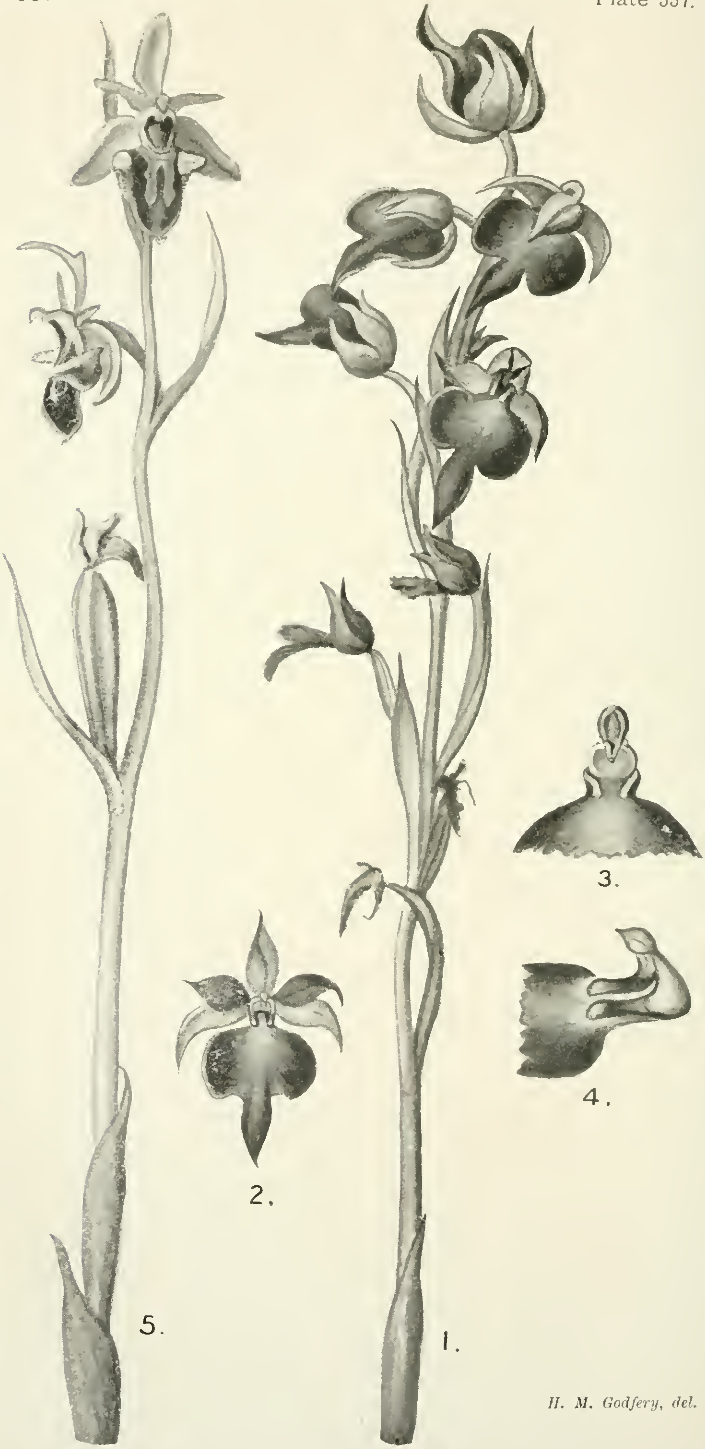

H. M. Godfery, del.

1. × *Serapicamptis Forbesii* Godfery (*Serapicamptis lingua* × *Anacamptis pyramidalis*).—2. Single flower, sepals and petals flattened out (nat. size).—3. Front view of column (enlarged).—4. Side view of column (enlarged).—5. × *Ophrys Cranbrookeana* Godfery

TWO NEW ORCHID HYBRIDS.

By Colonel M. J. Godfery, F.L.S.

(Plate 557.)

1. × Serapicamptis Forbesii.

(*Serapias Lingua* L. × *Anacamptis pyramidalis* Rich.)

Stem 22 cm. solid, cylindrical, glabrous. Leaves not gathered. Spike lax, 10-flowered. Ovary long (2½ cm.), slender. Bracts membranous, almost equal to ovary, narrow, lanceolate, acuminate, 3-nerved, tinged violet-red. Sepals free, spreading, lanceolate, acuminate, reddish violet, paler than lip, midrib darker, a faint nerve on one side only. Petals slightly shorter, lanceolate, acuminate, darker red-violet. Lip flat, 3-lobed, side-lobes semi-orbicular, entire, mid-lobe narrow, lanceolate, acute, mucronate, concolorous, deep crimson, of a peculiarly brilliant almost velvety appearance, covered with microscopic short hyaline papillæ. Column short, whitish, its walls produced on lip in two short raised slightly convergent sharp-edged ridges, concolorous with lip. Anther short, pear-shaped, apiculate, greenish. Fold of stigma clavate, red-violet. Rostellum violet. Viscid gland single, transversely oval. Pollinia small, dark brown. Caudicles ribbon-like, bright yellow. Stigma white.

The specimen described was found on May 5th, 1920, at Bordighera, Italy, and sent to me by Colonel A. M. Forbes, who wrote:—"The orchids growing near it in quantities were *pyramidalis* and *Serapias lingua*, with one small group of *S. longipetala* about 40 yards away. We have never seen a specimen of *O. laxiflora* in that neighbourhood (though there are some at the mouth of the Nervia), nor of *papilionacea*, which we have never found yet. My wife thoroughly searched the locality where she found it, but could not find any other specimen, but there was one *O. tridentata* on a lower olive-terrace."

The plant suggests so strongly the hybrids between *Serapias* and *Orchis* that it is evidently nearly allied to them. That the dominant parent is a *Serapias* there can be no doubt whatever, and it is almost equally certain that it is *S. lingua*. The size of the flower and of the lip suggest that species, and the shape of the lip is practically identical with that of *lingua* when flattened out—very different from the broad lip of *cordigera*, and equally so from the long one of *longipetala*. Hybrids between both the latter species and *Orchis* have a very much larger, broader, and more curved mid-lobe, much crisped and frilled at the edges, whilst in our plant the lip is flat in its natural position, with no fullness or frilling of any kind. Moreover, in both *S. cordigera* and *S. longipetala* the mid-lobe is densely covered with conspicuous hairs, whilst in *S. lingua*, though hairs exist, they are so much slenderer and fewer that the lip has often been described as glabrous. The lip in the present hybrid is glabrous except for microscopic papillæ invisible to the naked eye. Finally, the guiding-plates or callosities at the base of the lip in *S. longipetala* are distinctly divergent; in our plant they are slightly convergent.

It may fairly be concluded from these considerations, coupled with the fact that *S. lingua* was frequent where the hybrid was found, that that species was one of the parents.

To ascertain the other parent is not so easy. The abundance of *Anacamptis pyramidalis* in the immediate neighbourhood suggests that species, but it is rather shy of hybridization. The walls of the column in *pyramidalis* are prolonged in two erect guiding-plates on the base of the lip, analogous to the so-called callosities of *Serapias*, and the pollinia, as in *Serapias*, are affixed to a common gland. *Anacamptis* is therefore more closely allied to *Serapias* than is the genus *Orchis*, and, since hybrids are well known to occur between *Serapias* and *Orchis*, there is no inherent improbability in the idea of a cross between *Serapias* and *Anacamptis*.

Well-authenticated hybrids have been recorded between *S. lingua* and *Orchis papilionacea*, and also between *S. lingua* and *O. laxiflora*. As the late Mr. Bicknell (*Flowering Plants of the Riviera*, sub t. lxiv.) says that *O. papilionacea* has not been found at Bordighera, that species may be ruled out as a possible parent, especially since the published figures of *S. lingua* × *O. papilionacea* (Barla, Icon. Orch. pl. 22, figs. 4–8 and Camus, Mon. Orch. Eur. pl. 12, f. 337) at once put it out of court. *O. laxiflora* does not grow nearer to the place where our hybrid was found than the mouth of the Nervia, several kilomètres away. Comparison with drawings of *S. lingua* × *O. laxiflora* found by my wife and myself in Italy has convinced us that *O. laxiflora* is not one of the parents. We are therefore narrowed down to *A. pyramidalis*, which was plentiful in the neighbourhood, for though a single specimen of *Orchis tridentata* was found on a lower olive-terrace, there is nothing further to suggest the parentage of that species.

Of direct evidence of the influence of *A. pyramidalis* there is but little, but this is not surprising. The most salient features of that species are:—

(1) *The long spur.* No known hybrid between *Serapias* and *Orchis* shows any traces of a spur. As the influence of *Serapias* is so strong as to suppress this character entirely, we can expect no evidence in this direction.

(2) *The guiding-plates on the lip.* As the analogous callosity of *S. lingua* consists of one thickened cushion-like single mass, rounded at the apex and furrowed, its replacement in the hybrid by two quite distinct ridges may not unfairly be ascribed to the influence of *Anacamptis*.

(3) *The saddle-shaped viscid disc.* In the hybrid the rostellum is also transversely oval, so that in this respect we have a strong resemblance to *Anacamptis*. Moreover, in *S. lingua* × *O. laxiflora* the rostellum has "deux retinacles distincts" (Camus, Mon. Orch. Europe, p. 67). The fact that both pollinia are affixed to one single gland in *S. Forbesii* links it still more clearly to *Anacamptis*, and renders it more improbable that the second parent belonged to the genus *Orchis*.

The following points afford confirmatory evidence. The flowers are smaller than in *S. lingua* × *O. laxiflora*, the sepals and petals more acuminate, the side-lobes of the lip not so broad, and the mid-lobe considerably narrower, in all which respects it approaches *Anacamptis*. The colour of the lip is a peculiarly bright crimson, almost impossible to reproduce, reminding one of the brilliancy of the most vividly-coloured specimens of *A. pyramidalis* on the Riviera. The ovary is long and slender, as in *pyramidalis*, which owes the shape of its spike to the long ovaries of the lowermost flowers standing out at right angles to the stem. The bracts closely resemble those of *Anacamptis*; they are slightly shorter than the ovary, acuminate, membranous, and violet-red. In *S. lingua* × *O. laxiflora* they much exceed the ovary, are broader, sub-obtuse, herbaceous, and green. None of these characters amount to positive proof, but taken together they form a chain of evidence, in conjunction with the presence of *Anacamptis* in the vicinity of the hybrid, as conclusive as can be expected in cases of this kind.

A difficulty—at first sight a serious one—may be raised on the ground that *Serapias*, with no spur, is adapted for visitation by short-tongued insects, such as *Hymenoptera*, and *Anacamptis*, with its long spur, for *Lepidoptera*, which have a long proboscis, and that it is very improbable that both plants should be visited by the same insect. The spur of *Nigritella*, however, is only 2 mm. long, that of *Gymnadenia conopsea* 15 mm. Yet hybrids between the two are, in some localities, by no means rare. Difference in the length of the spur is not therefore such a bar to cross-fertilization as might be supposed. In spite of its short spur, Müller observed that *Nigritella* was visited by no less than 48 different species of *Lepidoptera*. The difficulty, therefore, is more imaginary than real.

2. × OPHRYS CRANBROOKEANA.

(*Ophrys arachnitiformis* Gren. × *O. scolopax*, Cav.)

Stem 22 cm. high. Lower leaves resembling *arachnitiformis*, upper lanceolate, enfolding stem, acute. Bracts longer than ovary, erect, lanceolate, inrolled. Sepals greenish white, tinged with rose, with one green nerve, the lateral ovate rounded, with revolute edges, appearing triangular, the upper arched forward, oblong, truncate. Petals ligulate, narrow, pale yellowish green, ciliate, hispid in front with short erect hairs. Lip 3-lobed, side-lobes densely hairy, forming two projecting cones, mid-lobe semi-cylindrical, but not so much so as in *scolopax*, dark purple-brown, marked with two parallel irregular lines joined at the base by a collar. Appendix small, turned up in front, intermediate between the parents.

I gathered this plant on April 19, 1920, in a wood near Hyères, France, under the impression that it was *O. arachnitiformis*, which in general appearance it much resembled, but the deeply-cut lip, with its forward-projecting conical side-lobes, so marked a character of *O. scolopax*, left no doubt as to the parentage of that species. It is not often that one finds a hybrid in which the evidence as to both parents is so clear. The two upper flowers had not yet been visited by insects, but the ovary of the lower flower was considerably developed. Both parents grew in the wood in some numbers.

I have named this plant after the Countess of Cranbrook, to whom science is indebted for the discovery of the following hybrids at Hyères:—*Orchis Rainei* Rouy (*O. Champagneuxii* × *O. saccata*) of which I found a further specimen this year "*Ophrys Rainei* Alb. et Jahand." (*O. arachnites* × *O. bombyliflora*) and *O. olbiensis* Godf. (*O. arachnitiformis* × *O. Bertolonii*). Last year she found, near Hyères, a single specimen of *Ophrys speculum* Link, a North-African plant. This was first discovered in France by Moggridge, who found one specimen in 1865, and one the following year, near Menton. It was not seen again till it was found at Les Salins by Raine in 1908, at which place it has since been searched for in vain.

Explanation of Plate 557.

1. × *Serapicamptis Forbesii* Godfery (*Serapias lingua* × *Anacamptis pyramidalis*). 2. Single flower, sepals and petals flattened out (nat. size). 3. Front view of column (enlarged). 4. Side view of column (enlarged). 5. × *Ophrys Cranbrookeana* Godfery (*O. arachnitiformis* × *O. scolopax*).

ON HIERACIUM AURANTIACUM L.

By H. W. Pugsley, B.A., F.L.S.

Among my pleasant memories of childhood is a bed of orange hawkweed in my grandmother's garden which I suppose caught my fancy through the striking colour of its flowers; and for the sake of this association the plant, which of course is not uncommon in gardens, has always had a place in my own small plot. Being thus familiar with this hawkweed, I was rather surprised in the summer of 1916 to notice in the grounds of the manse at Aviemore, Inverness-shire, a profusion of a form which seemed to me distinct from my plant, and on my way home I met with this same strange form in cultivation at Pepper Arden, in North Yorkshire, where it was remarkably luxuriant.

This form is not characterized by a constant abundance of long leafy stolons by means whereof the plant rapidly spreads in all directions, but produces intermittently shorter and mostly underground stolons which effect a much slower increase. Its leaves are larger, of a duller green, with shorter, stiffer, and more abundant hairs, and in shape elliptical or obovate-lanceolate rather than lingulate or oblong. Its panicles, moreover, have fewer but larger heads of an orange-red or brick-red colour instead of brownish orange. These differences in habit, foliage, and flowers give the two forms the aspect of two distinct species.

On my return home in 1916 I saw by a reference to my herbarium that in 1910 I had collected this broad-leaved form, naturalized near Galashiels, without appreciating its distinctness; and a large proportion of the British material in the National Herbarium at South Kensington, gathered mostly in the north, also belongs to this form.

In this collection is a specimen collected by G. Don in Banffshire, which formed in part the basis of the introduction of *H. aurantiacum* to the British Flora in *English Botany*, no. 1469 (1805), and from which the accompanying plate was probably drawn. The specimen is a dwarf one, perhaps grown on poor soil, and the flowers are badly coloured in the plate, but it is reasonably certain that the plant belongs to the broad-leaved Aviemore form, with which the description agrees. Backhouse, at p. 15 of his *Monograph* (1856), also refers to this form, and describes its rootstock as creeping, sub-stoloniferous, occasionally producing rooting stolons. Other British Floras describe the same plant; Syme's *English Botany* and Hooker's *Student's Flora* remark "stolons short or none"; and Babington's *Manual* "stoles often wanting." In Mr. Hanbury's *Monograph*, p. 7 (1889), which likewise mentions but one form, the stolons are said to be short or entirely absent, but the accompanying figure (no. 3) shows a distinct leafy stolon and narrow leaves, and I believe was not drawn from the broad-leaved form, although its flowers are sufficiently red.

It thus appears that the *H. aurantiacum* of British botanists generally is the broad-leaved form cultivated and naturalized in Scotland and elsewhere, and that the narrower-leaved stoloniferous and more weedy plant commonly grown in present-day English gardens was not formerly known in this country and has not been botanically distinguished here—albeit it is now not only cultivated, but also naturalized in various English localities.

In most modern Continental works few variations of *H. aurantiacum* have been noted other than those of the flower-colouring. According to Koch (Syn. Fl. Germ. ed. 1, p. 450 (1837)) the leaves may be oblong or obovate, and stolons present or absent—a description that would cover both of the British forms. Fries (*Epicrisis*, p. 24 (1862)) gives no varieties, but states that the plant, which is variable, is stoloniferous, with the leaves obovate or lanceolate. Rouy (Fl. de France, ix. p. 242 (1905)) describes a narrow-leaved form, which may be with or without leafy stolons, and adds one variety only. In DeCandolle's *Prodromus* (vii. p. 204 (1838)), however, Froelich diagnoses eight varieties. Unfortunately he does not well define the specific type, and the exsiccata cited (Herb. Willd. no. 14659, kindly lent for inspection by Prof. Engler) are rather fragmentary; but his first variety (*majus*) is clearly akin to our broad-leaved form, while the eighth (*repens*) recalls our narrow-leaved plant. This last will be further dealt with.

An elaborate treatment of the species is found in Naegeli and Peter's *Hieracien Mittel-Europas-Piloselloiden* (1885), where (p. 286) *H. aurantiacum* L. is divided into six groups, embracing nineteen subspecies. The group-characters are taken chiefly from the form of the phyllaries, the quantity of stellate hair on the involucres, and the colour of the leaves and flowers. The habit of growth and the other foliage-characters are considered under the separate subspecies, and rampant forms with narrow leaves may appear in the same group as others that are compact and broad-leaved. Geographical distribution is carefully shown throughout, though some of the subspecies are described from cultivated plants, and exsiccata are cited for some forms, but not uniformly. Except in the case of plants with yellow or externally-striped florets, the colour of the ligules is termed "purple," which seems to indicate that the diagnoses were drawn up from dried material, the living flowers being certainly never purple.

Of the six groups the first—*aurantiacum* proper—is characterized by rather narrow phyllaries, short acladium, "purple" flowers, very pilose stem, and bright green or subglaucescent foliage. It contains eight subspecies, of which the third, *H. aurantiacum* L., *sensu stricto*, clearly coincides with the narrow-leaved English garden-plant. This is evident not only from the description, but from the exsiccata sent out by the authors, which show leafy stolons freely produced at the time of flowering. A number of varieties of this subspecies are distinguished. of which our plant usually agrees best with var. *setulosum*, notable for the long hairs of its leaves. This subspecies is the most widely distributed form of the aggregate species, occurring throughout Central Europe and also in Scandinavia.

The broad-leaved British plant cannot be so surely identified with any of Naegeli and Peter's forms, but appears to be referable to the eighth and last subspecies (*claropurpureum*) of their first group *aurantiacum*. This subspecies, a native of Eastern Switzerland, is distinguishable by its partly underground stolons, its elliptical leaves with abundant stiff hairs above, its light-edged phyllaries, and its "clear purple" flowers. It seems to have been described from a cultivated plant, and no exsiccata for it are cited by the authors. Another subspecies of Eastern Switzerland, *spanochætium*, forming the collaborators' third group, is allied to this plant, and appears separable from subsp. *claropurpureum* only by its less hairy stem, more glaucous leaves, fewer but larger heads, and somewhat broader phyllaries. Flowering exsiccata of subsp. *spanochætium* in Herb. Mus. Brit. show no stolons and bear a considerable likeness to Don's Scotch specimen.

It may be concluded, therefore, that, of the two forms of *H. aurantiacum* known in Britain, one is referable to the Linnean type as defined by Naegeli and Peter, while the other is probably identical with their subspecies *claropurpureum*, though also resembling subspecies *spanochætium*. Naegeli and Peter's nomenclature may consequently be followed for the two British plants if they are regarded as belonging to one species.

The differences of the two British forms, however, are so marked that, treating them alone, it does not seem possible to regard them as conspecific, especially when the average standard of *Hieracium*-species is remembered. Unfortunately I have never met with any wild forms of *H. aurantiacum* in Central Europe, and am thus the less able to judge whether a complete series of intermediate states between the different subspecies is likely to exist, so that no clear dividing-line is practicable. But the points of distinction between our two plants are so obvious, in spite of the dark hair-clothing of the inflorescence and the reddish flowers that are seen in both of them, that, after studying Naegeli and Peter's diagnoses, one seems warranted in doubting whether the basis of their grouping is sufficiently broad and whether sufficient importance is allowed to the differences in habit and foliage. The two British forms appear to me to show more essential differences than any of Naegeli and Peter's primary groups, and I am therefore disposed to treat these two forms as two full species, under which many of the collaborators' subspecies may be placed. Taking this view, it becomes necessary to consider whether the Linnean type is correctly fixed by Naegeli and Peter.

Hieracium aurantiacum is thus described by Linnæus in *Species Plantarum*, p. 801 (1753) :—

"HIERACIUM foliis integris, caule subnudo simplicissimo piloso corymbifero. *Hort. Cliff.* 388. *Hort. Ups.* 238.

"H. hortense floribus atropurpurascentibus. *Bauh. pin.* 128. *prodr.* 65.

"H. alpinum non laciniatum, flore fusco. *Bauh. pin.* 128. *prodr.* 65.

"H. germanium I. *Col. ecphr.* 2, p. 28, t. 30.

"Pilosella polyclonos repens major syriaca, flore amplo aurantiaco. *Moris. hist.* 3, p. 78, t. 8. f. 7.

"*Habitat in* Syria, Helvetia."

In the second edition (1763) the habitat becomes "In Syriæ, Helvetiæ, Austriæque sylvis."

It will be observed that Linnæus here furnishes no diagnosis, but relies entirely on citations from older works. The first of these is from his own *Hortus Cliffortianus* (1737), where the meagre description is of less importance than the citations, all of which, with one doubtful exception and excluding C. Bauhin's *H. alpinum non laciniatum*, distinctly relate to a broad-leaved garden-plant. The exception is *Pilosella indica* Cornuti, *Canada*, p. 209 (1635), a plant said to have been brought from the Indies, of which little is known, but which is represented in the Sloane Herbarium (H. S. 319, f. 203) by what seems to be the broad-leaved garden form of *H. aurantiacum*. The final citation in Hort. Cliff. is *Auricula muris hispanica* from the posthumous *Historia* of John Bauhin, ii. p. 1040 (1651), which gives a full and accurate account of the plant, mentioning its underground stolons, its large, rough, distantly denticulate leaves, some exceeding two inches in breadth, and the notable colour of its flowers. An interesting remark is that the author first saw this plant in 1608 in the royal garden at Stuttgart.

Linnæus's second reference, his *Hortus Upsaliensis* (1748), adds nothing material to the first one. The third citation, from Caspar Bauhin's *Prodromus* (1620) and *Pinax* (1623), describes a garden-plant with leaves three inches broad; and the fourth, from the same works, a smaller plant which the author suggests is the wild form of the larger one. It is remarkable that the native habitat of this wild form is given as Eastern Switzerland (Rhætia), whence Naegeli and Peter record their broad-leaved subspecies *claropurpureum* and *spanochætium*. In the *Pinax* a reference is given under the garden-plant to a figure in Besler's *Hortus Eystettensis* (1613) which clearly recalls our broad-leaved Scottish form.

Linnæus's fifth citation, from F. Columna's *Ekphrasis* (1616), concerns a cultivated plant obtained from the mountains of Germany, which is said to be of creeping habit and with large foliage. A good woodcut is given, representing a plant with oblanceolate, acute leaves, and a close panicle of many heads. The exact characters of this plant are uncertain, but it is identified by C. Bauhin with his wild plant from Eastern Switzerland.

The sixth and final citation, from Morison's *Historia* (1699), is shown both by the description and the figure to refer to our broad-leaved garden-plant, and is identified by the author with the cultivated plants of John and Caspar Bauhin already mentioned. The plant is apparently called "syriaca" in error, the name being taken from *Pilosella syriaca* C. B. Pin. (quoted among the synonyms), which was founded on *P. maxima syriaca* of Lobel and Tabernæmontanus, a Syrian plant with square stem and opposite cauline leaves that is not a hawkweed.

It will be seen from Linnæus's citations that the hawkweed which he named *H. aurantiacum* was primarily a broad-leaved garden-plant known to many of the older botanists, whose descriptions are mostly free from ambiguity, and that a montane Swiss plant, with less defined characters but reputed to be its wild form, was included with it. Linnæus apparently knew nothing of its native country, the habitats Syria and Switzerland being evidently copied from Morison and C. Bauhin. It is not mentioned in the *Flora Suecica*, for Linnæus was not aware of its occurrence in Scandinavia.

A synonym of this species earlier than any of those cited by Linnæus is the *Hieracium IX.* of Clusius's Hist. Rar. Plant. i. lib. 5, p. cxlii (1601). Clusius mentions the stoloniferous habit, and comparing the umbelliform flowers with those of the common hawkweed, he writes "sed colore longe elegantiores, nempe impense flavos et quasi aureos." The plant is stated to have been raised in Holland from seed obtained from Vienna.

The identity of the broad-leaved garden-form described by Linnæus and earlier authors with the form grown in Scotland may be seen by a reference to Parkinson, Gerard, and Ray.

Parkinson (*Paradisus*, p. 300 (1629)) furnishes a good description of it as a British garden-plant under the name of *Pilosella major*, one of the synonyms in C. Bauhin's *Pinax*. The description contains an allusion to its broad leaves, which are well shown on the accompanying plate, and an English name "Golden Mouse-Eare" is introduced.

The plant is not mentioned by Gerard himself, but in the second edition of the *Herball*, lib. 2, p. 305 (1633), T. Johnson accurately diagnoses it as *Hieracium hortense latifolium*, and furnishes a specially good figure which unmistakably represents our Scottish broad-leaved form. Johnson also identifies it with the cultivated plants of C. Bauhin and F. Columna cited by Linnæus, and with the plate in *Hortus Eystettensis*. He mentions that it is a rare garden-plant, and quaintly brings in a second English name, saying: "The stalkes and cups of the floures are all set thicke with a blackish downe or hairinesse as it were the dust of coles; whence the women, who keep it in gardens for noveltie sake, have named it Grim the Colliar." This is an allusion to a humorous comedy, popular in

Queen Elizabeth's reign, called "Grim the Collier of Croydon." Parkinson curiously objected to this name as "both idle and foolish."

Ray (*Historia*, i. lib. 5, p. 243 (1686)) adopts J. Bauhin's name for our plant, adding those of Parkinson, Johnson's Gerard, and C. Bauhin as synonyms, and drawing attention to its probable identity with *Hieracium IX.* of Clusius.

It is thus reasonably certain that the plant intended by all these authors is the broad-leaved form known in Scotland, naturalized and in cultivation, and that this form was at one time, if not at present, extensively grown on the Continent.

A reference to the Linnean Herbarium, where the specimen of *H. aurantiacum*, though fragmentary, can be seen to belong to this form, confirms this view; moreover, the ten specimens of *Auricula muris hispanica* in the Sloane Herbarium (indexed in the copy of Ray's *Historia* in Herb. Mus. Brit.) can likewise be seen to be all this same form, showing that it was the plant in general cultivation and commonly known to the botanists of that period. It may be added that the old name "Auriculæ muris," or "mouse-ear," also points to this plant.

It therefore seems established that this hawkweed, which was introduced into gardens in various European countries about the end of the sixteenth or beginning of the seventeenth century, became widely known owing to the unique colour of its flowers, and, as a garden-plant, formed the basis of Linnæus's account of *H. aurantiacum*. Linnæus's name must therefore remain with this form if it is separated as a species from our rampant, narrow-leaved plant that Naegeli and Peter take as the specific type of *H. aurantiacum*.

A wild and a garden variety of this species, both with broad leaves, are given by Haller (*Hist. Helvet.* p. 21 (1768)), who distinguishes them by the colour of the flowers being orange and red respectively. Jacquin (*Flora Austriaca*, v. t. 410 (1778)), depicts in a very fine coloured plate a subalpine form of the broad-leaved plant, with underground stolons, foliage somewhat more lanceolate, acute and toothed than in our garden-form, and rather large, deep red flowers.

The earliest undoubted reference to a narrow-leaved *H. aurantiacum* seems to be that in Allioni's *Flora Pedemontana*, i. p. 213, and iii. tab. 14. f. 1 (1785). The plate here pourtrays a plant, gathered on Mont Cenis, with narrow, oblong leaves, and, as Allioni states in the text, sulphur-coloured flowers with fimbriate-laciniate ligules. This figure, representing a monstrosity, is strangely cited by Naegeli and Peter for their subspecies *claropurpureum* var. *occidentale*.

Another narrow-leaved form is described and figured by Vahl in *Flora Danica*, vii. p. 5 and tab. 1112 (1799). The plant drawn shows a long, leafy stolon, oblong-spathulate leaves, and orange-coloured flowers; and it is clearly akin to Naegeli and Peter's typical subspecies *aurantiacum* and the narrow-leaved British garden-form. This plate, however, like Jacquin's, is not cited by Naegeli and Peter. This is the first record of the occurrence of *H. aurantiacum* in Scandinavia.

In 1800 a distinct species of this group was described by Willdenow in Spec. Plant. ed. 5, p. 1564, as *H. repens*, with a diagnosis "H. scapo ramoso multifloro nudo piloso, foliis oblongis obtusiusculis integerrimis, stolonibus repentibus," the flowers being stated to be "saturate flavi." This plant is reduced to a variety *repens* of *H. aurantiacum* by Froelich in De Candolle's *Prodromus*, vii. p. 204 (1838), but is made a synonym? of *H. prussicum* (*H. collinum* × *Pilosella*) by Naegeli and Peter (*l. c.* p. 373). Through the kindness of Prof. Engler I have been able to see the type-specimen in Willdenow's herbarium, no. 14663. This has the facies of a narrow-leaved *H. aurantiacum*, but when carefully examined it is found to lack both the red colouring of the ligules and the black involucral hairs characteristic of that species, and I think it is probably a hybrid such as Naegeli and Peter suggest, although the long pilose hairs of the stem seem to show the influence of *H. aurantiacum*. Willdenow's name cannot therefore be adopted to represent Naegeli and Peter's narrow-leaved type.

In works subsequent to De Candolle's *Prodromus* I have been unable to find this narrow-leaved rampant plant distinguished either as a species or a variety, except by Naegeli and Peter, by whom it is treated as the true *H. aurantiacum* L., *sensu stricto*. It has been shown at length that this name really belongs to the broad-leaved garden-form, and as it is intended, for reasons already explained, to deal with the two plants as distinct species, a new name for this narrow-leaved form is required. It is therefore proposed to rename it *H. brunneo-croceum* in allusion to the colour of its flowers.

In thus dividing this group of hawkweeds into two species, I am fully aware that while this treatment should serve readily to distinguish the two plants known in Britain, it may not be of equal use in elucidating the relationships of the various wild Continental forms, with which I am unacquainted in nature, and of which I have examined only the limited collections in Herb. Mus. Brit. and (partially) at Kew. But the forms described by Naegeli and Peter seem largely divisible into two groups, whereof one may be distinguished by a predominance of underground stolons and a tendency to broad, elliptic foliage, while the other set has more pronounced, leafy stolons and narrower, oblong leaves; and I think that a large proportion of these forms can thus be naturally associated with the two species recognized in this paper.

I may add that I have not traced the origin of the narrow-leaved form as an inhabitant of British gardens. I have reason to believe that the particular plants I knew as a child were brought with *Centaurea montana* from Western Switzerland in the early seventies, but of this I am not certain. The form being widely distributed, however, it is not unlikely that it was introduced at different times from various habitats and then disseminated by gardeners owing to its very easy propagation. Examples from different localities sometimes show minor differences that may be derived from the wild stocks.

The two species may be diagnosed thus:—

Hieracium aurantiacum L. Sp. Pl. 801 (1753); Smith, Eng. Bot. no. 1469 (1805); Syme, Eng. Bot. ed. 3, v. 166 (1866);

H. aurantiacum subsp. *claropurpureum*? Naegeli & Peter, Hier. Mittel-Europ. Pilosell. 291 (1885).

Pilosella major Park. Parad. 300, cum icone (1629); *Hieracium hortense latifolium* Gerard, Herb. ed. 2, lib. 2, 305, cum icone bonâ (1636); *Auricula muris hispanica* Ray, Hist. i. lib. 5, 243 (1686).

Icones. Jacquin, Fl. Austr. t. 410 (forma foliis angustioribus lanceolatis dentatis); Eng. Bot. no. 1469.

Exsicc. G. Don, Banffshire, in Hb. Mus. Brit.! *Baker*, Wilton Woods, Cleveland, Yorks. in Hb. Mus. Brit.! *Trimen*, Stanmore Heath, Middlesex, 1866, in Hb. Mus. Brit.!

Stolons rather short, mostly underground and scaly, producing rosettes of leaves round the parent plant. Stem rising from a radical rosette of leaves, 20–60 cm. high, pilose with spreading hairs 4–5 mm. long; hairs, except near the base of the stem, dark or black-based, mixed with dark, glandular and stellate hairs above, with 1–4 leaves in the lower half, decreasing upwards. Panicle corymbose, often only 2–4-headed when naturalized, but up to 20-headed in cultivation. Acladium and peduncles floccose and black-glandular, sparingly pilose with dark hairs. Bracts grey-floccose and pilose externally. *Leaves elliptical, or*, especially when cultivated, elongate below and becoming *obovate-lanceolate*, commonly 10–20 cm. long (but reaching 30 cm.), and 2·25–6 cm. (rarely 7 cm.) broad, obtuse or mucronate, with the inner and cauline acute, subentire or distantly denticulate (very rarely subdentate), deep dull green or glaucescent, *pilose*, on the upper side *abundantly, with stiff*, light-coloured *hairs* 2–4 mm. long; marginal hairs shorter (1·5–2 mm.). *Heads* about 25 mm. in diameter, *deep orange-red* or brick-red (sometimes purplish when dried), with involucres 8–9 mm. long, nearly truncate below. *Phyllaries* rather broad, obtuse, dull green, or when dried, blackish green, *with rather broad, pale margins* (inner red-tipped), slightly flocculose, pilose with dark hairs mostly 2–3 mm. long, and with scattered dark glandular hairs. Styles light livid but appearing yellowish in contrast to the red ligules.

Native in Eastern Switzerland and probably in the Tyrol and Austria.

Cultivated for over three centuries on the Continent and in Britain; now grown here chiefly in the north of England and in Scotland.

Naturalized in many Scotch localities, as Banffshire (*Don*), Forfarshire (*Gardiner*), Perthshire (between Killin and Kenmore, *R. Brown*, 1793), Kinross-shire (*D. Stuart*), Lanarkshire (Bothwell Woods, Glasgow, *J. P.* 1870), and Selkirk (Galashiels, 1910!); and in England at Berwick-on-Tweed (*Hb. Hume*), Yorkshire (*Baker*), Middlesex (*Trimen*), and Isle of Wight (St. Lawrence, *D. Cooper*).

Hieracium brunneo-croceum, sp. nov.

H. aurantiacum auct. mult. non L.; *H. aurantiacum* subsp. *aurantiacum* Naegeli & Peter, *l. c.* 288.

Icon. Fl. Danica, t. 1112 (ut *H. aurantiacum*).

Exsicc. Hier. Naegel. nos. 17!, 80!, 122! E. S. Marshall, no. 4190! (omnia ut *H. aurantiacum*).

Stolones, saltem in cultis, longi, vulgo supra terram foliosi sed

nonnumquam infra squamosi, tandem folia rosulata e quibus caules floriferi crescunt gerentes, per æstatem totam producti ut planta late serpat. Caulis gracilescens, 10–60 cm. altus, basin versus folio supremo minimo 1–4-foliatus, omnino pilis fuscis 3–6 mm. longis patentibus pilosissimus, superne parce floccosus et pilis obscurioribus basi nigrescentibus glandulisque numerosis nigris brevioribus vestitus. Ramificatio corymbosa, pauca-25-cephala, florifera densa, fructifera laxior. Acladium pedunculique floccosi, parce pilosi, dense nigro-glandulosi. Bracteæ virides, externe pilosæ. Folia angusta, oblongo-lanceolata lingulatave aut interdum oblanceolata basi attenuata, 6–10 cm. (raro 16 cm.) longa, 1·25–2 cm. (raro 3 cm.) lata, obtusa vel mucronata (interiora caulinaque acutiora), subintegra vel obscure sinuato-denticulata, dilute viridia, superne setis plus minusve longis (2–5 mm.) sæpe numerosis inferne marginibusque pilis brevioribus rarioribus vestita (in formis umbrosis minus breviusque pilosa). Calathia circa 20 mm. in diametro, brunneo-crocea sed interdum in medio pallidiora (in sicco obscuriora). Periclinium 7–8 mm. longum, inferne rotundatum vel tandem truncatum. Squamæ angustæ, obtusæ, olivaceæ (in sicco nigrescentes), marginibus obscure vel obsolete pallidis, interiores apice rubro-tinctæ, omnes plus minusve flocculosæ, pilis fuscis vel nigris ad 4 mm. longis et basin versus etiam glanduliferis nigris brevioribus pilosissimæ. Styli pallide lividi, per ligulas croceas, ut videtur, lutescentes.

Stolons, at least when cultivated, *long, mostly above ground* and leafy, but sometimes underground and scaly, terminating in rosettes which develop flowering-stems, *continuously produced* and enabling the plant to spread rapidly. Stem rather slender, 10–60 cm. high, very pilose throughout with spreading dusky hairs 3–6 mm. long, sparingly floccose and with darker or black-based pilose hairs mixed with numerous dark glandular ones above; with 1–4 leaves towards the base, decreasing upwards. Panicle corymbose, few-25-headed, dense in flower, but laxer in fruit. Acladium and peduncles floccose, sparingly pilose, and densely black-glandular. Bracts green, externally pilose. *Leaves narrow, oblong-lanceolate* or lingulate, *or* sometimes *oblanceolate* and attenuate below, 6–10 cm. (rarely 16 cm.) long and 1·25–2 cm. (rarely 3 cm.) broad, obtuse or mucronate (inner and cauline more acute), subentire or obscurely sinuate-denticulate, pale green, *with* more or less abundant *pilose hairs of variable length* (2–5 mm.) above, and more sparingly and shortly pilose below and on the margins (in shade-forms less and more shortly pilose). *Heads rather small*, about 20 mm. in diameter, *brownish-orange* (darker when dried), but sometimes paler in the centre, with involucres 7–8 mm. long, rounded or finally truncate below. *Phyllaries* narrow but obtuse, dark green (blackish when dried) *with obscure* or obsolete *paler margins* (inner tipped with red), more or less flocculose, abundantly pilose with dark hairs up to 4 mm. long, and with black glandular hairs intermixed towards the base. Styles light livid, appearing yellowish in contrast with the ligules.

Native in the hilly districts of Central Europe from Savoy and Piedmont to North Germany, Galicia, Transsylvania, and the Banat; also in Sweden (ap. Naegeli and Peter).

Cultivated in Britain for over fifty years and now frequent in English gardens.

Naturalized in Worcestershire (Selly Oak, *Thompson*, 1902); Leicestershire (Bellgrave, *Bell*, 1909); Oxfordshire (Great Tew, 1876); Carmarthenshire (Glynhir, *Ley*, 1876); W. Somerset (Culbone, *Hayne*, 1867); N. Devon (Trentishoe, *Carruthers*, 1883, and Barnstaple); W. Cornwall (Newlyn East, *Reid*, 1903); and probably in other counties.

THOMAS WALTER (1740?–88) AND HIS GRASS.

By James Britten, F.L.S.

The herbarium of Thomas Walter, author of the *Flora Caroliniana*, is one of the most interesting collections in the Department of Botany. Its history is given in a note, probably in the hand of the younger John Fraser (fl. 1799–1852), on the first page of the folio volume containing it: "The Herbarium of Thomas Walter, Esq., of South Carolina, author of the 'Flora Caroliniana,' pub^{d} 1788. Presented May 23, 1849, to the Linnean Society of London, by John Fraser, son of John Fraser, the indefatigable North American Botanical Collector from the years 1786 to 1811, who died in London the latter year." It was purchased by the Department at the sale of the Society's surplus collections in 1863, for the small sum of fifteen shillings.

Each specimen is mounted, through a slit, on a small piece of paper of irregular shape, which was apparently cut from another volume in which the collection was originally contained; this was cut up and rearranged alphabetically—probably by Fraser: on each of these slips the name (sometimes incorrectly applied) is in most cases written. The names are mostly in two hands: sometimes both appear on the same ticket. Mr. S. F. Blake and I, when he was over here in 1915, spent some time in investigating these, and the conclusions we arrived at are given in his paper on Walter's plants in *Rhodora*, xvii. 130. I am not, however, quite satisfied: for example, on the label of *Spiræa trifoliata*, which Mr. Blake accepts as Walter's the word stamens is spelt "stemnys," which one can hardly suppose Walter, who was evidently a man of considerable education, would have written: I do not, however, think this is in the same hand as the other labels identified by Mr. Blake as Walter's. On the other hand, in the labels attributed to Fraser "nova genera," as a singular, is of frequent occurrence, and this appears also in Fraser's printed list. Most of the labels bear a number; I have not found out to what this refers. On the first page is inscribed "Walter's Herbarium 1786–1788. J. F." (*i.e.* John Fraser), and it is on their resemblance to this that the identification of the labels is based. A few of the specimens were loose in the volume when it was received; these were fastened down when it was re-bound. The plants described in the *Flora* are not all represented in the herbarium; the specimens are usually small, but mostly sufficient. Many of them bear names in Smith's hand, added when the collection was at the Linnean Society.

The importance of the collection was early recognized by American botanists. Pursh (Fl. Amer. Sept., pref. xvii: 1814) consulted it when it was in the possession of the sons of John Fraser, and quotes some of the names in it in his book. It seems to have attracted but little attention from English botanists, as when Asa Gray made inquiries for it on his first visit to England in 1839, Brown and Bentham knew nothing of it; Lindley, however, discovered it in the possession of John Fraser, who sent it to the Horticultural Society's rooms for Gray's inspection. Gray * gives an account of it in the Journal which he wrote for John Torrey: he found "the examination very tedious, as the specimens are very often not labelled, except with the genus in his [Walter's] 'Flora,' so that I have first to make out his own species, and then what they are of succeeding authors. The specimens are mostly mere bits, pasted down in a huge folio volume. I suspect this was done by Fraser, and the labels have sometimes been exchanged, so that it requires no little patience. Some of the things I most wished to see are not in the collection, and there are several in the collection which are not mentioned in the 'Flora.' You would laugh to see what some of the things are that have puzzled us: thus, for instance, his '*Cucubalus polypetalus*' is *Saponaria officinalis*!, his '*Dianthus carolinianus*' is *Frasera*! in fruit." Gray is probably right in his identification of the wretched specimen of "*C. polypetalus*" with *Saponaria*—though Pursh (Fl. Amer. Sept., 316) had doubtfully referred it to his *Silene ovata*, which is based on a specimen in Herb. Banks endorsed: "Cherrokee Countrey, W. V. Turner, 1769: Indian name Ounenake Ounostaatse—White root": but the *Dianthus* is not *Frasera*, but *Dodecatheon Meadia*. Gray made notes on the collection which, or a copy, he sent to Torrey; if these are anywhere preserved, their publication would be of considerable interest.

Since the herbarium came into the possession of the Department of Botany it has been consulted by most American botanists who have visited this country: on its pages are the names or initials of Asa Gray (at a later date than that of his first inspection), A. A. Eaton, L. H. Bailey, N. L. Britton, C. S. Sargent, Oakes Ames, S. F. Blake, and Miss A. M. Vail. Mr. A. S. Hitchcock published in the *Sixteenth Annual Report of the Missouri Botanic Garden* (pp. 31–56) the identification of Walter's Grasses, and Mr. Blake in the course of a paper on "Some Neglected Names in Walter's *Flora Caroliniana*" (*Rhodora*, xvii. pp. 129–137: 1915) has notes upon some of the specimens.

The MS. of the *Flora*, as is generally known, was brought to England at the beginning of 1788 by John Fraser and published by him in London in that year at his own expense. The somewhat lengthy title may be worth transcribing, as it indicates the extent of the work and its somewhat ambitious scope: "Flora Caroliniana, secundum Systema Vegetabilium perillustris Linnæi digesta; characteres essentiales naturalesve et differentias veras exhibens; cum emendationibus numerosis: descriptionum antea evulgatarum: adumbrationes stirpium plus mille contineus: necnon, generibus novis non paucis, speciebus plurimis novisq. ornata. Auctore Thomas Walter, Agricola." The preface, which is in Latin, is dated: "Carolinæ Meridionalis, ad Ripas Fluvii Santee, 30 Dec., 1787": the author apologizes "si nonnulli in compositionem subitaneum irrepserint errores," and says: "Stirpes plus mille hoc opere comprehendi mirum fortasse videatur, quum cognitum fuerit vix non omnes collectas fuisse ex area non ampliore quam quæ linea bis duplicata quinquaginta millium passuum circumscribi potest: etiam multæ adhuc latent, ut quotidie docet experientia." Many of the grasses and cryptogams, he adds, remain untouched, as well as many trees, shrubs, and herbs, with the fructification of which the author was insufficiently acquainted.

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* *Letters of Asa Gray*, i. 134–6 (1893).

The fullest account of Walter's botanical work is that given by Fraser in his *Short History of Agrostis Cornucopiæ* (1789)—a rare folio publication devoted to the description and history of a grass found independently by Walter and himself, of which more will be said. Having described his journey to Charlestown, Fraser continues: "The botanical description of many of the plants which I found, are contained in the FLORA CAROLINIANA with the author of which, the late MR. WALTER, I became acquainted soon after my arrival in Carolina. He had collected, when I went into that country, plants which afforded him six hundred and forty descriptions. I increased his work, by the specimens I produced to him, to one thousand and sixty, amongst which are upwards of *two hundred new species*, and *thirty new genera*; of all which, as well as the other plants in the FLORA, I have now dried specimens in my possession, and many valuable living plants. Many of the most valuable specimens and living plants I collected are still remaining in my hands, undescribed.

"I cannot pass over this part of my narrative without paying the tribute which I owe to the memory of this excellent man: it is to the friendship which he shewed me that my perseverance in continuing these researches was in a great measure owing; and I found in him all that knowledge of the science to which I myself was not sufficiently equal, and which greatly contributed to give a proper direction to my enquiries.

"Mr. Walter, in the midst of the woods in America, without the aid of books, or learned collectors of natural history, made his descriptions with an accuracy that is allowed to be by no means inferior to the most eminent botanists in Europe, and which discovers that he possessed ability far beyond my humble praise."

The relationship between Walter and Fraser was evidently very friendly, apart from their joint business interest in the grass. Walter commemorated Fraser in his *Flora* in the genus *Frasera* and in *Magnolia Frasera*, a plate of which—"presented to Thomas Walter, Esq^{r}., as a testimony of gratitude and esteem by his much obliged humble servant John Fraser"—faces the title-page. Fraser dedicated to Walter the shrub first published as *Cliftonia*: Endlicher (*Genera* 1413) cites as a synonym of this "*Walteriana* Fraser msc." and it appears in Fraser's List (see Journ. Bot. 1899, 485) as

Walteriana, nova genera, a very beautiful evergreen shrub": two specimens bearing the name in the hand supposed to be Fraser's are in Walter's herbarium, to one of which Nuttall has attached the specific name "*Fraseri*."

The fullest account of the author of the *Flora* is contained in an article entitled "A Visit to the Grave of Thomas Walter" by W. C. Coker, published in the *Journal of the Elisha Mitchell Scientific Society*, xxvi. pp. 31–42 (Chapel Hill, N. C., 1910). This contains a picture of the grave—he was buried in his garden, now overgrown—and a copy of the inscription on his tombstone, which runs thus:

"In memory of THOMAS WALTER native of Hampshire in England and many years a resident of this state. He died in the beginning of the year 1788 [the exact date, we learn from Fraser, was Jan. 18] aetatis cir. 48 ann. To a mind liberally endowed by nature and refined by a liberal education he added a taste to the study of Natural History and in the Department of Botany science is much indebted to his labours. At his desire he was buried on this spot once the garden in which were cultivated most of the plants of his FLORA CAROLINIANA. From motives of filial affection his only surviving children ANN and MARY have placed this memorial."

We learn from Mr. Coker's paper that Walter "came to South Carolina as a young man, acquired a plantation on the banks of the Santee river, in St. Steven's [*sic*] parish, and made it his home for the remainder of his life. His house was built within a few feet of the southern edge of the wild swamp of the Santee river, and adjoining it he marked out and planted with paternal care one of the first botanical gardens of America, those of John Bartram and Humphrey Marshall alone having preceded him." He was married twice and had four children, whose subsequent career Mr. Coker narrates. A notice quoted by Prof. Sargent in *Garden and Forest*, x. 302, describes Walter as "an English gentleman whose devotion to the cause of Science led him to the wilds of Carolina": there seems, however, little foundation for this—nothing is known of Walter's early life, and on his title-page he styles himself "Agricola."

Reference has been made to the grass to which Fraser in 1788 devoted a folio publication, and to which Walter gave the name *Cornucopiæ perennans*; the trivial of this is retained by Tuckerman under *Agrostis* and by Michaux under *Trichodium*. Mr. Hitchcock in the paper already referred to says that "In 1789 . . . . [p. 872] Fraser wrote an article in the *Gentleman's Magazine* entitled 'Fraser's Carolina Grass,' in which he gives a good description accompanied by a plate." The article, however, is not by Fraser, but by the editor ("Sylvanus Urban"), who embodies in it much of the account in Fraser's *Short History*, with which Mr. Hitchcock does not seem to have been acquainted. He apologizes for the previous publication (p. 685, t. ii. figs. 1–3) of a figure and description of a nondescript grass as that of Fraser, and gives a plate (t. i) of the true plant with Smith's description—the former reduced and the latter quoted from Fraser's work, to which, curiously enough, no reference is made. The writer notes that the grass "had been sent by Professor Kalm from Canada to Linnæus, and a specimen has been found in the Herbal of Linnæus by Dr. James Smith, of London, who purchased that valuable collection. But. although found there, it is not described by Linnæus; and it does not appear that there was any other specimen of it, than that found in the Herbal, in the possession of any person in Europe, previous to Mr. Fraser's arrival from America." The specimen from Kalm, to which Smith has attached his diagnosis, is in the Linnean Herbarium.

The history of the introduction of the grass into cultivation and of the high anticipations formed both by Walter and Fraser of its importance are set forth at length by the latter in his work. It affords a curious parallel to the excitement which was aroused in England, of which a summary will be found in the later editions of Withering, by the introduction from Ireland of the form of *Agrostis stolonifera* known as "Fiorin Grass." The two "agreed to become joint proprietors of the grass," and Fraser "undertook to introduce it into Great Britain and other parts of Europe." Walter advertised it extensively in America, and corresponded with Fraser about it on the latter's return to Europe: a portion of one of Walter's letters may be quoted (dated Feb. 18, 1788):—

"I am in great hopes that you are by this time safely arrived in England. The winds with us, since your departure, have been high. and frequently north-westerly; the cold piercing, and more severe than before. The ink in my standish, by the fire-side, has been frozen into flakes; yet our noble Grass has borne it all well, and the weather having within these few days become warm, it is thriving rapidly. I expect to obtain an exclusive patent for vending the seed. People here have to pay as much attention to it as they do to most things, but at the same time hardly know how to believe their senses, and often ask with some degeee of amazement how I came by it?" He is "anxious to know the fate of [his] Flora, and what opinions are formed of the author among your great men. Will they allow of a little merit, or do they give no quarter? Pray be ingenuous and explicit with me. If they find fault justly, I'll take care to correct it. If they are mistaken. I will endeavour to make it clear." But his chief interest is in the grass, on account of which he expects "to be recorded in historic page as another Triptolemus." This classical allusion to the *protégé* of Ceres and the fact that his *Flora* is written in Latin shows that Walter was a man of education: he refers to the grass as "Donum inæstimabile, Conditore ad hanc diem reservatum, hoc ævum, me instrumento, locupletatum!" (*Flora*, p. 74).

In October of the same year, Walter sent Fraser twenty bushels of the seed to be sold at two guineas a quart; but the death of the former and the misfortunes of the latter brought about the failure of the scheme. The publication of Walter's account of the grass was, Fraser tells us, "opposed by the most violent prejudices, and by a great many no sort of credit was given to the veracity of my friend's description." "To add to this very unpleasant situation," Fraser had to engage in a law-suit with the man to whom he had sent his American collections, in which he was defeated, and in order to save himself and his family from ruin was compelled to make an immediate sale of the collections he had brought back with him. A great part of his dried plants was brought by L'Heritier, and he seems to have sold a good quantity of the grass seed. Owing to the circumstances indicated, however "the neat returns" admitted only of "a very small dividend between myself and the executors of my worthy friend Mr. Walter, who, to my inexpressible regret, and to the loss of the world in general, died of a fever in the month of January last, to whom I wish to ascribe all the merit of the discovery of the importance of this valuable plant, and whose memory will be thereby rendered immortal."

I do not know whether authentic specimens of the plant are rare: Mr. Hitchcock mentions that there is one in the De Candolle Herbarium at Geneva. It is not represented in Walter's collection, but in Herb. Banks is one endorsed by Dryander "Fraser 1789." It appears in Fraser's List (c. 1790) as "Agrostis cornucopiæ from seeds collected at Chelsea," with a reference to Walter's *Flora*. We have also a specimen (from Edward Forster's herbarium) from Curtis's garden, labelled by Forster "Frazer's Grass," under which name it seems to have been commonly known.

"WISTMAN'S WOOD."

[The following abstract of a communication made to the Linnean Society by Mr. Miller Christy at its meeting on Feb. 3 is taken from the "Proceedings" of the Society, no. 382, to which it was supplied by the author.]

Wistman's Wood is a small unique grove of ancient but exceedingly gnarled and diminutive oak-trees (all *Quercus pedunculata*), growing out of an extensive pile of huge angular blocks of granite (known locally as a "clatter"), without a particle of visible soil. The wood is hung (so to speak) upon the steep left bank of the West Dart, about two miles north from Two Bridges, almost in the centre of Dartmoor, and at an elevation of about 1500 feet. Its area is small (about 5–6 acres at the outside), and the number of trees comprised in it is probably not more than from 300 to 400, in spite of statements to the contrary.

Wistman's Wood is not a remnant of a primæval forest which once covered Dartmoor, for none such can ever have existed. It may be, however, the only survivor of other similar groves which once occupied some of the deeper and more sheltered valleys. It owes its continued existence, beyond question, solely to the "clatter" of granite blocks out of which it grows; for this protects it, not only from fire, but also from all animals grazing on the Moor; these being unable to cross it, owing to the steepness of the slope and the *crevasse*-like open spaces between the great masses of rock, which are piled together in great confusion. For the same reason, access to the wood is, even for human beings, a climb or scramble, rather than a walk; while, within the wood itself, progress is even dangerous, owing to the *crevasses* being hidden by an abundant growth of moss, many tussocks of *Luzula sylvatica*, and other herbage.

The oaks (with which grow two or three bushes of *Pyrus Aucuparia*, but no other kind of trees) are all exceedingly dwarfed.

Their average height is, perhaps, 10 feet, the highest not exceeding 15 feet. Many are of bushy or scrubby habit, presenting no definite stem, and few (if any) have a stem 4 feet high. In the case of adult trees, presenting measurable stems, the average circumference ranges from 14–60 ins., but one measured reached 78 ins. Yet these toy-like oaks are unquestionably of great age—probably well over 500 years—as has been proved roughly by cutting sections in order to count the number of concentric (annual) rings. This has been done on several occasions; but the results have not been conclusive, owing chiefly to the narrowness and closeness of the rings, due to extreme slowness of growth, from the hard conditions under which the trees exist.

The trees are remarkable also, apart from their small size, by reason of their fantastically-gnarled and twisted branches, reminding one strongly of the tiny Japanese trees grown in pots for decorative purposes. A feature still more unusual (at any rate, so far as oaks are concerned) is the extent to which even the topmost branches of the older trees are overgrown by huge masses of moss, long shaggy lichen, and *Polypodium vulgare*, giving them an enormously bulky appearance. . . . . Yet, in spite of many statements to the contrary, the trees appear healthy (there being none either dead or dying). Moreover, they produce acorns, though few in number. There are also young trees.

The wood has long been known, and there have been many notices of it in print. The earliest was, probably, that of Tristram Risdon, written just three centuries ago, which shows the wood to have been then almost exactly the same, in all respects, as now. The others (which include an "Ode" to the wood) are, for the most part, too incorrect, or too pervaded by ideas of "Druids" and "Pyxies" as inhabitants of the wood, or too tinged with poetic fancy, legend, and superstition, to present many points of scientific interest. The present is believed to be the first adequate description of the wood.

HENRY WILLIAM LETT.

(1838–1920.)

The too limited number of Irish botanists has been further reduced by the death in December of Canon Henry William Lett, which occurred at his residence, Aghaderg Glebe, Loughbrickland, Co. Down. Born at Hillsborough in the same county in 1838, he was educated at Trinity College, Dublin, was ordained in 1871, and, after occupying various posts, became, thirty-four years ago, rector of Aghaderg.

An active clerical worker, Lett was a many-sided man; he was a member of the Belfast Naturalists' Field Club, in which he took an active interest, of the Royal Irish Academy, and of other bodies, and contributed to their publications. His first paper was an appendix to the *Proceedings of the Belfast Club* (1884–5, 265–316) on "The Fungi of the North of Ireland"; long before this, however, he had taken up the study of mosses and hepatics, to which his work was later practically restricted, as the *Flora of the North-east of Ireland* contains a reference to a MS. list of these prepared in 1860–87. Lett's first notes in this Journal appeared in 1895, to which for many years he contributed; his longest contributions were the list of mosses and hepatics of South Donegal (1903, 356), the description of a new hepatic (*Adelanthus dugortiensis*), and notes on *Hypopterygium*, with a description of a new species, *H. immigrans* (1904, 201, 249).

Lett's most important production was the *List with Descriptive Notes* of British Hepatics (1902), which was somewhat severely criticized by Mr. Symers McVicar in this Journal for the same year (p. 424); some of the corrections were embodied in his *Catalogue of British Hepatics* (1904). Lett was an original member of the Moss Exchange Club; his "Census Report on the Mosses of Ireland" (Proc. R. I. Acad. xxxii.; 1915) contains a list of records for the botanical divisions of Ireland (on which he had written in this Journal for 1906 (p. 412) with a valuable bibliography and biographical notes; biography always interested him, and formed the subject of his presidential address to the Belfast Naturalists' Club in November, 1912, on "Botanists of the North of Ireland" (Proc. Belfast Club, 2 ser. vi. 615–628). Much of Lett's work was done in conjunction with a brother clergyman, C. H. Waddell, who predeceased him in 1919 (see Journ. Bot. 1919, 358).

James Britten.

SHORT NOTES.

Carex Pairæi in Ireland. Last summer Mr. A. W. Stelfox sent me a couple of stems of the above that had been gathered in Co. Dublin, and further details of the find have just come to hand. The plant was noticed first by Dr. Scully in 1919 by the roadside near Sandyford, about 8 miles S.E. of Dublin, growing on the sides and summit of a dry, rocky and sandy ditch; this was reported, under the name of *C. muricata* in the *Irish Naturalist*, 1919, p. 90. In 1904, when Colgan's *Flora of Dublin* appeared, *C. Pairæi* had scarcely been recognized by botanists in these Islands, and in that work *C. contigua* only appears as a very rare plant with only one accepted station—"Near Stepaside on the way to Holly Park (Moore). Cyb." Mr. Stelfox thinks this may be the same locality as Dr. Scully's present one. The latter, I am told, is sandy and dry, and this coincides with my experience of the habitat in which I have seen the species growing in England and Wales, a favourite one being a well-drained hedgebank or sandy common. Mr. A. B. Jackson, however, says (B. E. C. Rep. 1914, 170) that the plant seems to prefer somewhat moister situations than *C. contigua*; my experience is rather the opposite. He also mentions that he has seen Irish examples of *C. Pairæi*, but no localities or counties are given.—C. E. Salmon.

Orchicœloglossum mixtum Asch. & Græbn. In the *Orchid Review* for Nov.–Dec. 1920, the Editor. Mr. R. A. Rolfe, calls attention to this hybrid in connection with the death of its original discoverer, Mr. Cecil Henry Spencer Perceval, of Longwitton Hall, Morpeth, which occurred in May last. The plant was first published by Mr. Rolfe in the *Annals of Botany* (vi. 325; 1892) as *Habenari-orchis viridi-maculata*—a name, framed in accordance with the Candollean rule, which indicates its parentage: the description and accompanying plate were taken from Mr. Perceval's specimen, which was collected at Longwitton in July, 1891. The discoverer succeeded in preserving and increasing the plant, and early in 1919 sent tubers to Kew, where it flowered in the rock-garden. In the *Orchid Review* for 1919 (p. 144), from which the above information is taken, Mr. Rolfe records the appearance of a very similar plant at Levally, near Enniskillen, where two specimens were found in July of that year. "Some ten years after the original plant appeared, an *Orchis mixta* Domin was described (Sitz. Böhm. Ges. Wiss. xxii. 7) from a single example found on the mountains on the north-east frontier of Bohemia, which was said to combine the characters of *Cœloglossum viride* and *Orchis maculata*; this plant afterwards became *Orchi-cœloglossum mixtum* Asch. & Græbn. (Syn. Mitt. Eur. iii. 287)" (Rolfe, *l. c.*). Mr. Perceval contributed short notes to this Journal in 1893–4; he was for many years interested in Fungi, and many of the drawings in the Wheeler collection are from specimens furnished by him. In 1872 Percival found specimens of *Battarea phalloides* in the Earl of Egmont's grounds at Nork, near Epsom; these formed the subject of a paper communicated by him to the British Association in 1875 and published in the Report for that year (part 2, 158); see also Journ. Bot. 1916, 106.—JAMES BRITTEN.

AGROSTIS NIGRA IN FRANCE: A CORRECTION. In this Journal for 1913, p. 196, was recorded the finding in the Var of what I supposed was *A. nigra* With. Recently on examination of two specimens, and comparison with English examples of that little-known grass, I was not satisfied with the determination; and on sending a specimen to Dr. Stapf he told me it was *Poa trivialis*! I much regret this bad mistake, through attempting to determine in the S. of France, without reference to actual specimens, a grass which a generation ago under Bagnall's tuition in the Midlands I got to know well.—H. STUART THOMPSON.

ATRIPLEX CALOTHECA: A CORRECTION. I regret to find that the plant recorded (Journ. Bot. 1920, 295) under this name proves not to be that species; the record must therefore be withdrawn.—ARTHUR BENNETT.

REVIEWS.

The Marine Algæ of the Danish West Indies. By F. BØRGESEN. Copenhagen: Bianco Luno. Vol. i., 222 pp., 170 figs., 1913–14; vol. ii., 498 pp., 435 figs., 1915–20. 8vo.

THE Marine Algæ of the West Indies have attracted the attention of naturalists ever since the time of Sir Hans Sloane; specimens dating from the beginning of the XVIIIth Century are preserved in his herbarium in the British Museum. The first large methodical collection made in the region was that of Mazé who explored the coasts of Guadeloupe. A few sets of these algæ, named and numbered, are in existence; but, in the light of our present knowledge, they need a drastic revision. In recent years sundry papers have been published by various authors on West Indian algology, but the real investigators of the region are Dr. Marshall A. Howe and Dr. F. Borgesen. The former has collected extensively in Porto Rico, Jamaica, Cuba, &c., and has published complete local lists in Dr. N. L. Britton's Floras of the Bahamas and Bermuda, besides other important papers. Dr. Borgesen, on the other hand, has confined his researches to the Danish West Indies. This small group of islands was transferred to the United States in 1917—a lasting source of grief to the majority of the Danish people! From its geographical position this group afforded a convenient entity for algological investigation and for a special monograph—a task which was undertaken with patriotic and scientific enthusiasm by the author of the present volumes. His collections were made during three visits—February to March 1892, December 1895 to January 1896, December 1905 to April 1906,—the present monograph of his results being issued in yearly parts from 1913 to 1920. It comprises the Chlorophyceæ (90 species), Phæophyceæ (45), and Rhodophyceæ (192), the Cyanophyceæ being omitted. The section Melobesieæ is the work of Madame Lemoine, and the Rhizophyllidaceæ and Squamariaceæ are contributed by Madame Dr. Weber van Bosse. Every species, and in some cases the genus, is fully and critically discussed and illustrated by excellent figures of habit and structure. The ecological aspect of the flora was to have been studied during a special visit in 1915; but this was prevented by the outbreak of the Great War.

A period of publication extending over eight years naturally necessitated the addition of an appendix. This comprises 73 pages and contains a revised list of the species, in which are inserted descriptions of many novelties and revisions of certain genera in the light of the most recent investigations.

A few instances will be of interest. Eleven species of *Galaxaura* are recorded and discussed in the text, their values and positions being based on Kjellman's monograph; but in the appendix they are reduced to five, as a consequence of Dr. Howe's investigations (1918), which revealed the dimorphic character of each natural species, and showed that what had hitherto been regarded as two distinct species are but the sexual and tetrasporic generations of one and the same.

The treatment of *Acrochætium* is of equal interest. Owing to their microscopic size, the West Indian members of this epiphytic genus had mostly escaped notice. In the present work twenty-five species are recorded, all but one of which are novelties detected by the author's keen eye. A helpful key to the specific characters is supplied and is founded on the distinctive features afforded by the base of the *Acrochætium* in relation to the host-plant, thus following on the lines of Bornet. Sexual organs were detected in one species only—*A. Sargassi.*

Interesting also is the discussion of *Rhizoclonium*, a genus hitherto specially characterised by the presence of lateral rhizoids and by the absence or extreme rarity of the original attachment—the basal end-rhizoid; but in all the many specimens examined by Dr. Børgesen there were no lateral rhizoids at all, and in most of the specimens the original basal rhizoid was present and was vigorously developed, forming the sole and efficient means of attachment to the rocks in rough water. Such plants are difficult to distinguish from *Chætomorpha*, but the author points out a number of minor characteristics which serve to separate these two genera.

The curious structures detected on *Liagora* by Dr. Howe and described by him (1920) as "Monosporangial discs" are discussed in the appendix. They occur on several species collected by Dr. Børgesen, but most abundantly on *L. elongata*. They are described and figured in various stages of development, including a fruiting plant bearing a two-celled sporangium, whereas Dr. Howe had only found monosporangia, these being fairly frequent. Dr. Børgesen failed to detect any organic continuity between the discs and the *Liagora* host-plant, and therefore inclines to Dr. Howe's alternative view that the discs are independent structures living in the mucous layer of *Liagora*.

These instances serve to indicate the great value of Dr. Børgesen's work and the thoroughness with which he has carried out his researches. His monograph will be of the utmost service to all concerned in the investigation of the algal flora of tropical America—and its value is immeasurably enhanced by the wealth of beautiful drawings, which reveal at a glance the structure of the plants and make clear all the points at issue. Moreover, the discovery of so high a proportion of novelties—five genera, sixty species, and numerous varieties and forms amounting to nearly one-fifth of the total list—gives the work such an importance as to render it indispensable.

In a final note on the geographical position of the algal flora of the Danish West Indies the author calls attention to its striking resemblance with that of the Indo-Pacific Ocean. This is especially applicable, he tells us, to certain, undoubtedly very old, groups of Chlorophyceæ. The Rhodophyceæ, on the other hand, show less resemblance to those of the Indo-Pacific, but are more closely related to those of the Mediterranean–Atlantic. The great similarity between the algæ of the West Indies and those of the Indo-Pacific—regions which are now so completely separated—is explained by the existence of an ancient connexion between the two oceans.

A. AND E. S. GEPP.

London Trees: an Account of the Trees that succeed in London, with a descriptive Account of each Species and Notes on their comparative Value and Cultivation. With Guide to where the finest London Trees may be seen. By A. D. WEBSTER. 8vo, cloth, pp. xii, 218; 32 plates. Price 15*s.* net. Swarthmore Press.

THE promise conveyed in the title of Mr. Webster's volume is admirably carried out in the book itself, which is indeed one of those whereof it may be said that it could not have been better done. Mr. Webster tells us in his preface that it "has no pretensions to contain a complete list of trees growing in London, but rather is a brief account of such trees as the author has thought worthy of note during the quarter of a century with which he has been connected with some of the Royal parks and gardens of the metropolis"; but it certainly contains all that anyone is likely to want to know about them, and is a valuable contribution to London history, rendered additionally so by the numerous excellent illustrations, all of London-grown trees.

An introductory chapter—in the course of which the "barbarous and unscientific" way in which trees are pruned or lopped is severely criticized—contains interesting references to the influence of trees on place-nomenclature: Gospel Oak, for example, and Seven Sisters Road—named after a group of seven elm trees, 300 years old, that were removed in 1852 when they were replaced by others that stood till quite recently: "the quantity of trees of that name that grow in the marshy grounds of the East End was the origin of Poplar." The present writer remembers when a part of the Fulham Road, at the top of Church Street, not far from the Consumption Hospital, was known as "Queen's Elm," from a tradition, which finds support in the Chelsea parish books of the period, that Elizabeth took shelter there under an elm tree growing at that spot; not very far from it was Walnut-tree Walk, a name which, as Mr. Webster says, still exists in Lambeth.

The main portion of the volume follows, the trees being arranged in alphabetical order under their English names. There is no attempt at botanical description, the trees for the most part being familiar to all, but the localities where specially fine examples may be seen are indicated, and a great deal of interesting information is given. Thus we learn of a *Catalpa* in the gardens of Gray's Inn which bears a tablet inscribed: "Said to have been planted by Francis Bacon when Master of the Walks, 1597": it is curious that this tradition should have obtained credence, seeing that, as Mr. Webster points out, the tree is understood to have been introduced to English gardens by Catesby about 1728. One would not expect to find a *Cotoneaster* in a list of trees, but "in some of the royal parks *C. frigida* has attained to a height of 30 feet, and is therefore well ahead of the 20-foot range which differentiates a shrub and a tree"; Tamarisk also, in Battersea Park, becomes a tree over 20 feet high, with a girth of of more than 2 feet. There is much historical information about special mulberry trees: "tradition and a label attached point to one of the old shattered trees at Charlton Park, Blackheath, as the first mulberry brought to England"; this tradition, Mr. Webster thinks, rests on what "appear to be substantial grounds," but he disallows the claim of one to have been planted by James I. in 1609, though that monarch formed mulberry gardens both in St. James's and Greenwich Parks. The mulberry under which Keats wrote the "Ode to the Nightingale" still exists in the garden of his house at Hampstead. The "London Plane" as it is called (*Platanus acerifolia*) is regarded by Mr. Webster as a variety of *P. orientalis*; but Prof. Henry in his interesting memoir on the tree, noticed in this Journal for 1919 (p. 295) regards it, in opposition to his earlier view, as a hybrid between *P. orientalis* and *P. occidentalis*. It is said that a tree which adds so greatly to the beauty of London should possess a "pernicious character," but Mr. Webster summarizes and endorses the evidence which regards "the minute spicules of the fruit" as responsible in many cases for throat troubles.

Having thus considered the trees separately, Mr. Webster proceeds to group them under the headings of parks, squares, gardens, open spaces, streets and churchyards, as to all of which his knowledge is "extensive and peculiar." The book concludes with "a handy reference guide to where some of the largest London trees are growing" and has an excellent index: it is very well printed, and in every way attractive.

Elementary Notes on Conifers. By A. H. CHURCH, M.A. Oxford Botanical Memoirs, No. 8, pp. 32. Oxford University Press, 1920. Price 2*s.* net.

Form-factors in Coniferæ. By A. H. CHURCH, M.A. Oxford Botanical Memoirs, No. 9, pp. 28. Oxford University Press, 1920. Price 2*s.* net.

THE teachers of various subjects in our universities seem to have come to the conclusion that, in the interests of the rapid acquisition of thorough knowledge, it is better for them to provide their students with lecture-notes than to leave the preparation of such notes to the students themselves. These modern lecture-notes are very different from those "analyses" or "aids" provided for the students of a former generation. The latter were essentially "cram" books for the lazy student desirous of obtaining the minimum knowledge necessary for a "pass" degree: the modern notes, such as the excellent series—not, we hope, completed—which Mr. Church prepares for the Forestry students at Oxford, demand the most active mental exercise of the intellectual athlete. The one class of books bears much the same relation to the other as a basin of weak beef-tea does to a solid lump of meat-extract. It is most useful for students outside his own university that Mr. Church has by their publication placed his thorough treatment of the subject within their reach. In these days of costly paper and printing we realise the advantageous conciseness of technical terminology; but a professor of botany, even at Oxford, is hardly expected now-a-days to be a supporter of "compulsory Greek," which Mr. Church's language practically shows him to be. Some Oxford men who remember Freeman's *Old English History*, for example, will regret the necessity—if it exists—for the use of language of which Mr. Church's opening sentence is a moderate example: the description of a land flora begins by stating it "as constituting the autotrophic vegetation of subaerial environment (behind the horizon of saprophytic phyla of Fungi), expresses the progression of plant-life from the medium of water to that of atmosphere." Such language painfully suggests the description of a man of science as "one as calls an 'ole a horifice."

The thoroughness and judgement of Mr. Church's work is shown, perhaps, as much in his plan as in the details of its treatment. He has apparently to give a course of from ten to fifteen lectures to students intending to become forest officers, who have had two or three terms' previous work of the same extent in elementary structural botany, the reproduction of angiosperms, and, perhaps, the morphology of fungi—a group of extreme practical importance to the forester. Of fifteen lectures—all of which are, of course, accompanied by practical work—he devotes two to the Bryophyta and Pteridophyta, taking *Polytrichum*, *Funaria*, *Marchantia*, *Aspidium*, and *Selaginella* as his main types. Four lectures are then devoted to *Pinus sylvestris*, one to the genus *Pinus* and its other more important species, seven to some sixteen other leading generic types, and a concluding lecture to the comparative anatomy of the coniferous foliage-leaf. The leading species, nearly fifty in all, are fully described or at least discriminated: there is even some reference to the extinct links in the series which are preserved to us as fossils; and the characteristics of the chief timbers are also given. This is, we think, an admirable steering between the Scylla of the type-system and the Charybdis of merely descriptive work. The so-called "alternation of generations" from Bryophyta upwards, the histology and development of the vascular bundles, the formation of heartwood and of knots, the adaptational factors of xerophytes, embryological recapitulation, seed-dispersal, germination, and the geographical distribution of pines, as well as the inevitable discussion of the morphology of the cones, are among the topics that receive thorough, if incidental, treatment in the first of the two series of lectures. What appears to us as the most valuable side to the whole of Mr. Church's teaching—the insistence on the thorough discussion of the precise homology of structures—is even more apparent in the second and much more advanced series of notes, which are professedly supplementary to the preceding series. After discussing phyllotaxis, branching, and dorsiventrality, seven lectures are devoted to the cones, two, intensely interesting, being in conclusion given to the relation of form-factors to phylogeny and classification, and monstrosities.

The two pamphlets are certainly not easy reading, but they will well repay the student of plant-structure for the labour that their perusal necessitates.

G. S. Boulger.

An Introduction to the Structure and Reproduction of Plants. By F. E. Fritch, D.Sc., Ph.D., F.L.S., and E. J. Salisbury, D.Sc., F.L.S. 8vo, pp. viii, 458; 2 pls. & 225 text-figures. London: Bell & Sons, 1920. Price 15*s.* net.

This volume has been prepared in response to the demand for a sequel to the *Introduction to the Study of Plants* by the same authors, from which the minute structure and details of life-history that require the use of a microscope for their proper comprehension were purposely omitted. References to the earlier book are included, and it is claimed that the two together form a comprehensive introduction to the science of Botany, covering the syllabus for all Higher School Examinations and adequate for the first-year student at the Universities. Their position as teachers in the University of London should enable the authors to estimate what it is desirable to include in a text-book for students preparing for examinations; the implied contrast between such students and those "who really desire to learn something of the rôle of plants in nature," for whom the work has been in the first instance compiled, is a little naive.

The subject-matter is divided into two parts, dealing respectively with (1) the anatomy and (2) the life-histories and reproduction of plants. The first five chapters are given to the plant-cell, its structure, physiology, and contents, with chapters on growing points and cell-division, and the differentiation of cells to form tissues. The structure of root, stem, and leaf are next considered, with a chapter on the epidermis and its modification to form stomates and hairs; then follow accounts of secondary thickening, cork-formation, and secretory organs. Part I concludes with a chapter on anatomy in relation to habitat, which is mainly a description of the departure from the more general type of structure in leaf and stem in association with xerophytic or aquatic conditions. The numerous illustrations are well-selected, clear, and very helpful in elucidating the details of structure; the majority are original.

Part II contains a sketch of the life-histories and methods of reproduction in the great divisions of the plant-world, from unicellular organisms upwards to the angiospermous flowering plant. The authors explain that the study of isolated types has been abandoned by them in favour of a more general account indicating the range of form and reproductive methods within each group. This challenges a comparison of the two methods, and it is conceivable that the more detailed study of a small well-selected series of plant-types may appeal more strongly to some teachers than the necessarily somewhat sketchy general survey which is practicable within the limits of a small text-book. In the present instance the authors have achieved a measure of success to which again the numerous illustrations contribute. Botanists of a former generation, who began their studies with a course of *Chara*, will note with a sense of change the relative non-importance now accorded to this family, which is dismissed in a foot-note to the Chlorophyceæ of less than three lines.

The final chapter, "Heredity and Evolution," forms an introduction to the principles and methods of study of variation, adaptation, mutation, geographical distribution, and evolution. An appendix deals with the structure and use of the compound microscope, the preparation of reagents, and methods of preserving and staining for microscopical work. There is an excellent index, which includes a number of subject-headings.

A. B. R.

A Manual of Indian Botany. By G. C. Bose. 8vo, cloth, pp. xvi, 368, 8 plates. Messrs. Blackie & Son: Bombay, London, and Glasgow. 7*s*. 6*d*. net in England.

In this *Manual of Indian Botany*, Professor G. C. Bose has given the Indian student an elementary text-book calculated to stir his mind to an interest in the flora of his country. Constant references are made to well-known native plants to illustrate the morphological and systematic points. By the addition of vernacular names in heavy type the Indian reader is kept in touch on every page with plants familiar to him. The book is well written: a broad and sympathetic treatment is noticeable, which will constantly keep the student's attention on the open-air activities of the vegetable world. Interesting references to special cases of insect-fertilization and seed-dispersal enliven the descriptions of the families, and, like much else in the

Manual, should encourage outdoor investigation and study. The volume throughout is profusely illustrated with text-figures, and there are eight attractive, though rather crude, whole-page illustrations in colour. The first 160 pages are occupied by morphology on the usual lines; the systematic part of about equal length follows, while the Manual is concluded by two Appendixes, a glossary, and an index. The second Appendix consists of an analytical key to the families of Indian plants.

It is more than half a century since Oliver published his *First Book of Indian Botany* and, although it may be true, as Bose writes in his Foreword, that "the text-books of Botany commonly used in India are not exactly suited to the requirements of the Indian student," we must not forget Rangachari's excellent *Elementary Botany for India*, published a few years ago, in which he uses only Indian plants to illustrate his points. In Bose's *Manual*, however, Indian botanical students who can afford to buy it will have a book of convenient pocket size, full of digestible information, remarkably well printed, and nearly free from typographical or botanical mistakes.

S. T. Dunn.

BOOK-NOTES, NEWS, ETC.

William Whitwell was born at Manchester, on October 30, 1839. His early days were spent at Llansaintffraid, where he imbibed the love for nature which was a dominant feature in his life; his special interest in botany dates from 1853, when he was a clerk in a warehouse at Leicester; in 1859 he entered the Taxes branch of the Inland Revenue, in which he continued until his retirement in 1902. Whitwell's official duties led to his residence in various localities; he took the opportunity thus presented to investigate the botany of the districts, whence resulted the records from East Yorkshire, Shropshire, Flint, Montgomery, Cheshire, Surrey, and Sussex, published in this Journal between 1887 and 1902. Although not a critical botanist, Whitwell was an exceedingly careful observer and collector; he was also a good correspondent: his specimens, labelled in his neat hand, are found in many collections. His published communications were usually brief, the longest being the papers on *Arenaria gothica* (Journ. Bot. 1889, 345) and *Botrychium matricariæfolium* (Journ. Bot. 1898, 291). He contributed to Dr. F. A. Lees's *Flora of West Yorkshire*, for which he compiled the index, and published in *The Naturalist* (1893, 25–40) notes on plants of the same region from the herbarium of John Tatham (1793–1875), of whom he gave some account. A booklet entitled *A Bachelor's Christmas Day*, privately printed but widely distributed, is a charming account of a winter walk, and conveyed to those who read it the impression of the gentle and sympathetic nature which endeared Whitwell to so many friends. In 1902 he left South London, where he was last officially employed, for Hagley in Warwickshire, close to the Clent Hills; subsequently he moved to Warley Green, Knowle, Warwickshire, where he died on Dec. 16 of last year. Towards the end of his life the deafness from which he had long suffered become total. As may be conjectured from the title of his booklet, Whitwell never married. In 1892 he was elected a Fellow of the Linnean Society: his extensive herbarium has been presented by his relatives to the Birmingham Museum.

At the meeting of the Linnean Society on Feb. 3, Mr. Miller Christy made the communication on Wistman's Wood which will be found on p. 74. Mrs. Agnes Arber gave an account of her paper "On the Leaf-tips of certain Monocotyledons," in which the leaves of Monocotyledons are studied from the standpoint of the Phyllode Theory—that is to say, it is assumed that these leaves include no region equivalent, morphologically, to the lamina of the Dicotyledon. It is concluded, on the evidence of comparative morphology and anatomy, that, in the case of simple Monocotyledonous foliage leaves terminating in a solid apex, and also in the case of spathe leaves ending in a similar tip, the main part of the leaf is of leaf-sheath nature, while the apex represents a vestigial petiole. In the case of those more complex Monocotyledonous leaves, which are differentiated into sheath, stalk, and "blade," certain cases are known in which the "blade" terminates in a solid apex. It is provisionally suggested that such apices represent the unexpanded tip of the petiole: in other words, the main part of the distal region of the leaft-stalk has developed into the "pseudo-lamina," while the extreme tip has remained relatively unmodified, retaining its solid petiolar character.

At the same meeting, Mr. T. A. Dymes communicated a paper on the seeding and germination of *Ruscus aculeatus*. In the south-eastern quarter of England the berries and seedlings perish by severe frost, although the adult is hardy. Many seeds fail to germinate, because immature. Germination begins in July or August with the extrusion of the radicle; the cotyledon remains within the endosperm. During the first season the plumule is merely a short axis, completely invested by scale-leaves; it remains underground from the close of the first season until the following summer. Frost kills many seedlings during the first winter. Better results are obtained by sowing, as soon as the seeds are ripe, at a depth of one inch than at a greater depth or in the spring. Survivors in the second season produce an axis some three inches long, bearing a few scale-leaves and, at the apex, about six phylloclades in the axils of scale-leaves, which are longer than those of the adult. The radicle perishes, and adventitious roots are produced of about five inches in length. During the second winter the seedlings are unable to withstand severe frost. There is no recapitulation of the ancestry by the seedling.

The *Proceedings of the Linnean Society* for 1919–20 includes as a supplement the papers read at the Banks Celebration in June 17 last:—"Banks as Traveller," by Dr. Jackson; "Banks as a Man of Science," by Dr. Rendle; and "Banks as Botanist," by Mr. Britten—the last with special reference to his MSS. and collections in the National Herbarium.

Rhodora for November last contains "Studies of some Boreal American Cerastiums of the section *Orthodon*," by M. L. Fernald and K. M. Wiegand. Although concerned only with the plants of the region indicated, the paper should interest British botanists, as the species dealt with include *C. alpinum*, *C. arcticum*, *C. vulgatum*, and *C. arvense*.

MESSRS. LONGMANS send us the first volume of a new (the third) edition of the *Introduction to the Chemistry of Plant Products*, by Dr. Paul Haas and Mr. T. G. Hill. A notice of the first edition appeared in this Journal for 1913 (p. 314); the present volume is similar in scope, although in some parts it has been rewritten and as far as possible brought up to date. The work, however, will now extend to a second volume, which will be devoted to more purely physiological problems, and will include some of the matter found in the first edition: to the nine sections of the earlier issue a short section on Aldehydes has been added. The table of contents is informing and well arranged, and there is an excellent index. Incidentally, the volume shows how the price of books has gone up: the first edition (1913), with 401 pages, cost 7*s*. 6*d*. net; the present, with 414 pages, is priced at 16*s*. net!

THE Bureau of Forestry of the Philippines continues to issue valuable reports, well printed, fully illustrated, and excellently produced. In No. 20 Dr. Augustus P. West, Professor of Chemistry in the University of the Philippines, collaborates with Dr. William H. Brown, Professor of Botany, in producing an account, extending to 230 pages with 73 plates, showing not only the floral portions, but also trunks of the trees producing *Philippine Resins, Gums, Seed Oils*, and *Essential Oils*: special attention has been paid to the local names, which are very numerous. Dr. Brown is also responsible for No. 21—*Wild Food-Plants of the Philippines*—produced in similar style, with 81 plates.

MR. RALPH W. CHANEY publishes as a contribution from the Walker Museum a *Flora of the Eagle Creek Formation* of the Gorge of Columbia River, in Oregon and Washington. A large number of new species are described and figured from the author's collections, made in 1916–17; these are now in the Walker Museum of the University of Chicago, from whose press the pamphlet is issued.

MISS MARJORIE F. WARNER, of the U.S. Department of Agriculture, is publishing in the *Gardeners' Chronicle* an interesting series of papers on "Horticultural Libraries in the United States," with notes on the more important of the books contained therein. Botanical libraries are included; the most important of these are those of the Arnold Arboretum, the Massachusetts Horticultural Society, and the Gray Herbarium of Harvard University, all in "Greater Boston"; the last and that of the Lloyd Library in Cincinatti are of special importance from the botanical standpoint. The other two, at the New York and Missouri Botanic Gardens are, on the other hand, very rich in gardening books. "The Missouri Garden at St. Louis has special reason to be proud of its pre-Linnean collection, comprising many herbals and early agricultural works, largely acquired by Dr. Edward L. Sturtevant, who was widely known for his studies on the evolution and history of cultivated plants, particularly esculents."

WE have received the first parts of the two volumes of a new and greatly enlarged edition of Prof. Penzig's *Pflanzen-Teratologie*.

which is being published by Messrs. Borntraeger of Berlin. The first includes a glossary and the earlier portion of what is evidently a very full bibliography, arranged under authors' names, of papers which have appeared in periodicals and transactions. The second volume contains the teratological portion, beginning with *Ranunculaceæ*: the first part (160 pages) extends to *Caryophyllaceæ*. In type and general get-up, this new edition is in advance of that published in 1890–94.

Mr. C. G. Lloyd has been intimately associated with mycology for so many years that we are surprised to find in the latest number (type-written) of his *Mycological Notes* (no. 64: Cincinnati, Sept. 1920) a notice of the late W. G. Smith, which shows a curious ignorance of the quality and extent of the work of that eminent mycologist. Mr. Lloyd speaks of "the books [Smith] wrote, or rather compiled" (!) and adds: "It is about as difficult for a man living in London to acquire an actual knowledge of fungi as for an Arab living in the desert of Sahara to write a book on the culture of ginseng." It is not necessary to refer to the full account of Smith (at least twenty years of whose life was spent at Dunstable) published in this Journal for 1918 (pp. 243–47) in order to obtain some idea of his work: notices of this appeared in so many quarters that it would seem almost impossible that Mr. Lloyd should have overlooked all of them.

The first instalment of the botanical exploration of French Tropical Africa, undertaken by M. A. Chevalier and others from 1898 to 1912 was published at the end of last year (*Exploration Botanique de l'Afrique Occidentale Française*; Lechevallier, Paris, price 63 francs). The volume contains an enumeration of the plants collected, with a botanical map; many novelties are indicated but not described, the descriptions being deferred until later volumes. The only index is one of the orders and the page-headings supply no information, hence the volume, of more than 800 pages, is difficult of consultation: it is a constant source of surprise to us that details of such importance should be so frequently neglected by authors.

In *Notes from the Royal Botanic Garden, Edinburgh* (no. lxi; dated Sept. 1920) Professor Bayley Balfour continues to describe new species of *Rhododendron*, mostly from China, whence the supply of novelties seems inexhaustible; seventy species are here named and described. Of *Primula*, which in the way of novelties runs *Rhododendron* close, Prof. Balfour describes from the same regions fifty-five novelties, with three of the allied genus *Omphalogramma*.

The *Verhandlungen* of the zoologisch-botanische Gesellschaft of Vienna are so well known and so highly esteemed by British botanists as well as zoologists, that the following appeal from one of the best-known Austrian botanists should meet with a favourable response. "Are there in England no well-to-do botanists as well as zoologists who would become life-members of our zool.-bot. Gesellschaft by a single payment of not less than £15? We are menaced with a catastrophe, for every sheet of print now costs us over 6000 Kronen; we are therefore compelled to invite the co-operation of foreign members. Each £15 would secure the publication of one part of the Verhandlungen." Contributions can be sent direct to Dr. A. Hayek, Margarethenstrasse 82, Vienna V., or would be received and forwarded by Mr. C. C. Lacaita, F.L.S., 13 Chester Square, S.W. 1.

The sixth part of the *Journal of the Botanical Society of South Africa* (1920) contains a paper by Mrs. L. Bolus on the *Compositæ* of Kirstenbosch, with a clavis to the genera and a plate illustrating the floral structure of the order. There is an article on "The Protection of Wild Flowers," from which it appears that "the Ordinance at present in force and the Proclamation thereunder," although apparently stringent, do not work satisfactorily, and suggestions are offered for better enforcement. The contents are more miscellaneous than the title would suggest: four pages are devoted to "Spiders at Kirstenbosch." We note the appearance of a second edition of Bolus's *Orchids of the Cape Peninsula*, prepared by Mr. Bolus and the late Miss Greene—"dated 1918 but only received in Cape Town in September 1920, owing to War difficulties."

The second part of Dr. Pole Evans's *Flowering Plants of South Africa* (Reeve, Feb.) contains figures by Miss K. A. Lansdell of *Freesia Sparrmannii* var. *flava*, *Crassula falcata*, *Clivia miniata*, *Gardenia globosa*, *Richardia Rehmanni*, *Adenium multiflorum*, *Clerodendrum triphyllum*, and of two of the Aloes (*A. Pienaarii* and *A. pretoriensis*) recently described by Dr. Pole Evans.

The *Annals of Botany* for January contains what is evidently an important paper on "Some General Principles of Plant Distribution as illustrated by the South African Flora," by Dr. J. M. Bews, Professor of Botany in Natal University College; with papers on the Anatomy of Ovule and Seed in *Gnetum Gnemon*, by M. G. Thoday (with plate); "The Missing Link in *Osmundites*," by Dr. Marie Stopes (1 plate); "On the Pollination Mechanism of *Incarvillea Delavayi*," by E. M. Cutting; "*Telephragmoxylon* and the Origin of Wood Parenchyma," by R. E. Torrey (1 pl.); "Life-history of *Nectria galligena*," by Dorothy M. Cayley (2 pl.); "The Increase in Area of Leaves and Leaf-Surface of *Cucumis sativus*," by F. G. Gregory; "On the Occurrence in Britain of the Ascigerous Stage of a 'Brown Rot' Fungus," by H. Wormald (2 pl.).

Rhodora for November last contains "Studies of some Boreal American Cerastiums of the section *Orthodon*" by M. L. Fernald and K. M. Wiegand. Although concerned only with the plants of the region indicated, the paper should interest British botanists, as the species dealt with include *C. alpinum*, *C. arcticum*, *C. vulgatum*, and *C. arvense*.

A course of lectures on the History of Plant Delineation will be given in the lecture room of the Botany Department, University College, Gower Street, W.C., on Wednesdays, at 5 P.M., as follows:—March 2, The Art of the Ancient Empires, and March 9, The Dark and Middle Ages, by Dr. Charles Singer; March 16, from the Invention of Printing to the late XVI Century, and March 23 from the late XVI Century to Modern Times, by Dr. Agnes Arber. The lectures, which will be illustrated by lantern-slides, are open to the public without fee or ticket.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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British Euphrasiæ. By CEDRIC BUCKNALL, Mus.Bac.

Index Abecedarius; an Alphabetical Index to Linnæus's Species Plantarum, ed. 1. Compiled by W. P. HIERN, M.A., F.R.S.

History of Aiton's 'Hortus Kewensis.' By JAMES BRITTEN, F.L.S.

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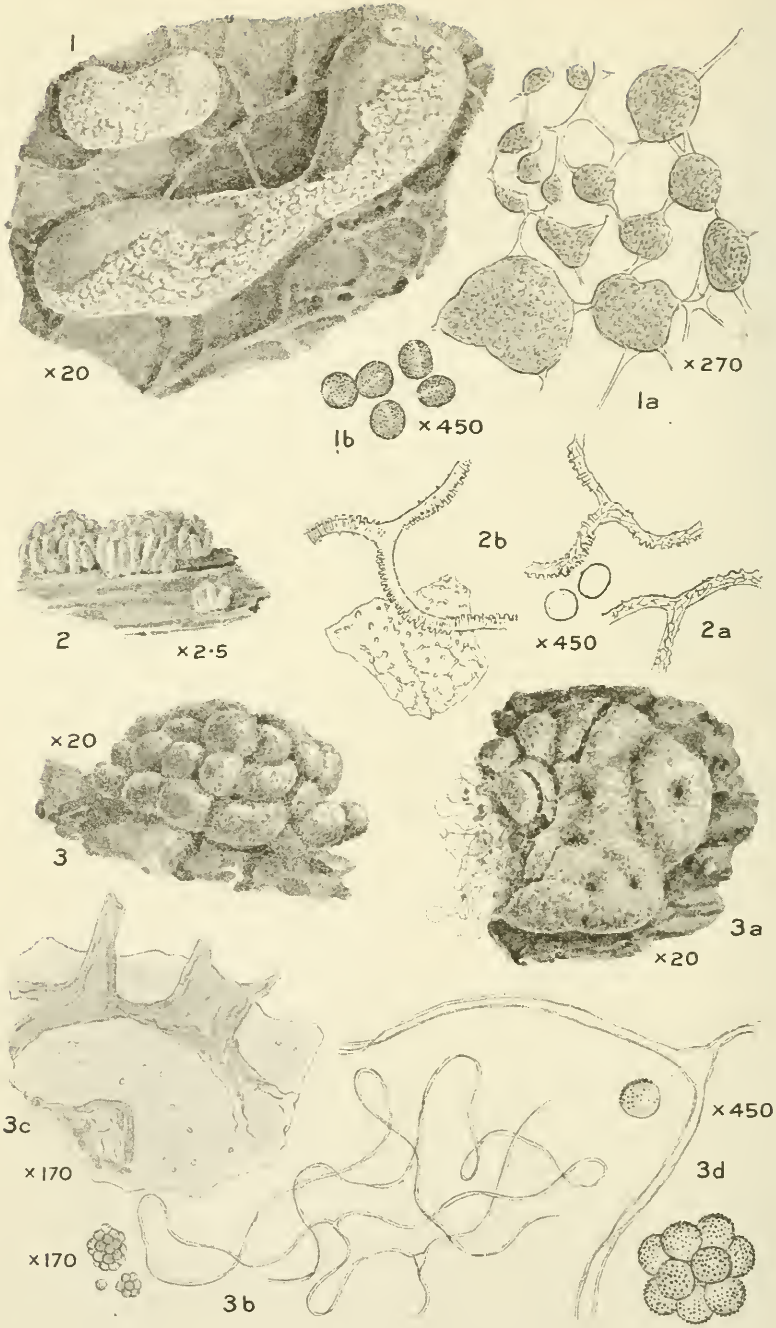
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1. Physarum ovisporum.
2. Arcyria carnea.
3. Minakatella longifila.

NEW OR RARE SPECIES OF MYCETOZOA.

By G. Lister, F.L.S.

(Plate 558.)

During the last few years several entirely new species of Mycetozoa have been discovered; and some forms, previously regarded as varieties only, have been found to retain their characters so well that it is more convenient to regard them as distinct species. The following notes refer to these and also to certain other species rarely met with hitherto:—

Badhamia viridescens Meylan, in Bull. Soc. Vaud. Sc. Nat., 1921. Plasmodium? Sporangia scattered or loosely clustered, stalked, globose, 0·5 to 0·8 mm. diam., pale sulphur-yellow or grey with a yellow base; sporangium-wall rugulose with dense deposits of lime-granules. Stalk 0·1 to 0·3 mm. high, furrowed, orange, or yellow above, orange-brown below, translucent when mounted, expanded at the base. Capillitium a coarse network of tubes charged with yellow or colourless lime-granules, sometimes with a few connecting hyaline threads. Spores lilac, nearly smooth, 8 to 10 μ diam. *Habitat* on dead wood.

This species appears to have been found first by Miss A. Hibbert-Ware in the Altyre Woods, Elginshire, in Sept. 1912, on lichen on a dead oak bough. In November, 1913, M. Ch. Meylan collected it at Côte aux Fées in the Jura mountains, at an altitude of 1100 metres; he again met with it near there in Sept. 1920. At one time we regarded it as a form of *Craterium aureum* Rost., to which it bears considerable resemblance; the *Badhamia*-like capillitium and the pale spores appear, however, to be constant distinguishing characters. The sporangia show a tendency to open by petal-like lobes.

Physarum atrum Schwein. The first British gathering of this inconspicuous species was made last September by the Rev. W. Cran, who found it on decaying shoots of Scots pine, at Durris, Aberdeenshire. The small purplish-grey sporangia are nearly destitute of calcareous deposits, and are less heaped together than is usual in this species. *P. atrum* is not unfrequent in fir woods in New England. In Europe it has been found several times in mixed woods near Berlin by Dr. Jahn; in Moldavia Dr. Marcel Brandza writes that it is abundant in mountain pine-woods, whence he has sent us fine examples.

Physarum digitatum G. Lister & Farquharson. Besides the type obtained by the late Mr. C. O. Farquharson in South Nigeria, this species has been found in the Knysna Forest, Cape Province, South Africa, by Miss A. V. Duthie. Part of a third gathering, collected at Preston, Ohio, by the late A. P. Morgan in 1895, was kindly sent me by Prof. Macbride. I had regarded it as a form of *P. virescens* Ditm., but the heaped clusters of small clay-coloured sporangia and the small spores marked with scattered clusters of warts agree in all respects with *P. digitatum*.

Physarum gyrosum Rost. The colour of the plasmodium of this species has been described as either white, creamy-white, yellow, or dull dirty white. Mr. K. Minakata records the appearance of a large plasmodium on the surface of the ground, near Tanabe, Japan, in October, 1918; it was at first white, but turned pale blue "as clear as Amazonite." He sends a coloured sketch of the striking appearance of the plasmodium as it spread in a network of blue veins over the wooden stopper of a "saké" cask, which had been laid on the ground in the hope that sporangia might form on it rather than on the crumbling soil: where the plasmodium dried rapidly the blue colour changed to milk-white, then cream-coloured, and at length to blood-red and blackish. Mr. Minakata refers to on old Chinese tradition that the blood of an innocent victim will reappear year after year on the spot where he was murdered, not as blood-red but as sky-blue in colour, and suggests that blue plasmodium of *P. gyrosum* emerging from the ground may have given origin to the belief.

Physarum ovisporum, n. sp. (Pl. 558, figs. 1, 1 *a*, *b*.) Plasmodium white. Sporangia scattered, sessile, white, pulvinate, or forming cylindrical, straight, curved, or irregular plasmodiocarps 0·5 to 0·8 mm. diam.; sporangium-wall minutely roughened with rounded deposits of lime-granules, often with smoother areas where the lime is thinly and evenly distributed. Capillitium consisting of numerous rounded white lime-knots, varying much in size, connected by short hyaline threads. Spores rich purple-brown or red-brown, either globose, 9 to 11 μ diam., or oval and 10×12 to 13 μ, minutely warted, usually marked on one side with a pale smooth line of dehiscence. *Habitat* on dead leaves. This rather puzzling form has been met with in late autumn and winter in the neighbourhood of Lyme Regis, Dorset, for the last thirty years; it has been found also in East Dorset, near Porlock, Somerset, and at Chingford, Essex. Although apparently allied to *P. vernum* Somm. and to *P. compressum* Alb. & Schw., it cannot well be attached as a variety to either of these species. From the former it differs in the minutely granular surface of the sporangium-wall and in the neat rounded lime-knots, and from *P. compressum* in the sporangia being always sessile and not compressed. When the spores are oval and marked with a line of dehiscence, they are unlike those of any other species in the genus; they are, however, occasionally globose and uniformly thickened. Even then the other distinguishing characters appear to be of sufficient importance and constancy for this form to acquire specific distinction.

Didymium Trochus Lister. By the rule of priority this name must be replaced by *D. vaccinum* (Durieu & Montagne) Buchet, see Bull. Soc. Myc. de France, xxxvi. 110 (1920). M. S. Buchet has made recently a careful revision of the collection of Mycetozoa in the Paris Museum, and has found there the type of *Diderma vaccinum* Dur. & Mont. It was collected near Algiers, in February 1840, on fallen branches of Opuntia. The sporangia are ochraceous-grey in colour and correspond, M. Buchet finds, in all respects with those of *Didymium Trochus*. This conclusion, as he courteously points out, confirms the suggestion put forward in *Mycetozoa*, ed. 2, p. 107, based on the resemblance of the illustration of *Diderma vaccinum* (in Expl. Sc. Alger. t. 22, figs. 1 *a*–*b*) to *Didymium Trochus*.

Didymium difforme var. repandum, n. var. Plasmodiocarps curved closely on themselves to form a flat plate, or widely expanded. Capillitium of hyaline threads, stout and simple below, repeatedly branched above. Tubular or funnel-shaped ingrowths of the sporangium-wall connecting the roof with the floor of the sporangium are often present. Spores 14 to 15 μ diam.

This robust form has been obtained from Bedfordshire, Hertfordshire, Sussex, and South Devon, and seems worthy of varietal distinction.

Lamproderma Gulielmæ Meylan, in Bull. Soc. Vaud. Sc. Nat. lii. 449 (1919). The characters of this species are the following:—Sporangia globose on slender black stalks, 0·4 mm. diam., silvery or iridescent blue spotted with dark patches corresponding to thickened purplish areas of the otherwise hyaline sporangium-wall. Capillitium pale brown or colourless, repeatedly branching with acute angles. Spores brownish-purple, strongly spinulose, 12 to 15 μ diam. *Habitat* on dead leaves of beech and on needles of conifers. This species was first described and illustrated by Dr. Marcel Brandza (in Ann. Sc. de l'Univ. de Jassy, x. fasc. 2, p. 196, pl. ii. fig. 3: 1916) from luxuriant growths found by him on dead beech leaves in the mountain woods of Moldavia. He regarded it as a variety of *L. echinulatum* Rost., and described the plasmodium as translucent yellow and the spores as closely reticulated. In a further gathering made in November 1919, part of which he kindly sends me, the spores are strongly spinulose with no reticulation, and the sporangia agree in all respects with M. Meylan's type of *L. Gulielmæ* from the Jura Mts. This species has also been found in Colorado, U.S.A., by Dr. W. C. Sturgis, Aug. 1914; in Aberdeenshire by the Rev. W. Cran, Sept. 1913; in Norfolk by Mr. H. J. Howard, Nov. 1918; and near Mürren, Switzerland, by Miss A. Hibbert-Ware and myself, Aug. 1912. In all these gatherings the characters are remarkably constant; the sporangia may even be identified in the field by their dark-spotted walls.

Lamproderma atrosporum Meylan var. anglicum G. Lister & Howard, in Journ. Bot. lvii. 25, pl. 552. This variety was found by Mr. H. J. Howard on dead beech leaves in woods near Norwich in April 1918, and proved to be the first British record for this species. The sporangia were shortly stalked or sessile, obovoid or subglobose, with a network of dark capillitium threads arising from a cylindrical columella, and dark, closely reticulated spores. Associated with these were numerous sessile hemispherical sporangia, usually without a trace of columella, the flaccid network of pale capillitium arising from the broad base of the sporangium; the pale purplish spores were faintly spinulose and measured 10 μ. We submitted the two sharply contrasted forms to M. Meylan: he agreed that the stronger was a variety of *L. atrosporum*, though less robust than the typical form which is frequent on the Swiss Alps—the weak form he thought might also prove to be that species; as we had at that time no proof of this, we named the more abundant weak growth *L. violaceum* Rost. var. *debile*. Last March, however, Mr. Howard was so fortunate as to find further developments in the Norfolk woods, in which all intermediate stages connecting the extreme forms occurred, completely justifying M. Meylan's suggestion. Another case in which these strong and weak forms are closely associated was observed by Mr. E. Brazier in a gathering on dead oak leaves made in June, 1920, near Stourbridge, Worcestershire. Here the var. *debile* has a colourless network of widely expanded threads, and well-formed but very pale grey spores. Without the evidence gained from the Norfolk specimens, it would have seemed quite unreasonable to have regarded this as a form of the stalwart black-spored *L. atrosporum* of the Alps. Such experiences make us realise how far we are from having mastered what the possibilities of variety may be in species of *Lamproderma*. As the result of these observations, the var. *debile* must be transferred from *L. violaceum* to *L. atrosporum.*

HEMITRICHIA OBRUSSEA Meylan, in Bull. Soc. Vaud. Sc. Nat. lii. 196 (1919). This name M. Meylan applies to the form hitherto referred to *H. Karstenii* Rost., in which the sporangium-walls are translucent and free from all deposits of refuse matter; it appears to stand in the same relation of *Trichia lutescens* Lister as *H. Karstenii* does to *T. contorta.*

Arcyria carnea, n. sp. (Pl. 558, figs. 2, 2 *a*, *b*.) This is the form described as *A. cinerea* Pers. var. *carnea* Lister in *Mycetozoa*, ed. 2, p. 236; it is, however, so constant that it seems better to regard it as a distinct species. The distinguishing features are the clustered flesh-coloured sporangia, with papillose and often reticulated cups, giving attachment to the capillitium; the threads of the latter are marked with close-set prominences, arranged in a loose spiral and appearing square-ended or notched when seen in profile; the remainder of the thread is either spinulose or marked with a broken reticulation or occasionally with three or four faint and irregular spiral bands; the spores are 7 to 8 μ diam. In the field *A. carnea* may resemble robust forms of *A. insignis* Kalchbr. & Cke., but the capillitium is far less flaccid in texture than in that species and the prominences are much more strongly developed. I have found it on old stumps in Essex and Hertfordshire; it has been obtained by M. S. Buchet in the Forest of Fontainebleau, by Dr. H. Rönn in Holstein, by Dr. Celakovsky, jr., in Bohemia, and by Mr. K. Minakata in Japan.

Both Schumacher and Wallroth published species under the name *Arcyria carnea*, but with descriptions too brief to be of value; they have been considered by later writers to refer to either *A. incarnata* Pers., *A. denudata* Wettst., or *A. cinerea* Pers., flesh-coloured forms of which are not unfrequent. It is quite possible that the present species may have been described previously as *A. carnea*, but in the absence of types this must remain uncertain.

Minakatella, n. genus. Sporangia clustered, more or less united into an æthalium. Capillitium forming a coil of nearly simple smooth tubular threads. Spores spinulose.

M. longifila, sp. unica. (Pl. 558, figs. 3, 3 *a–d*.) Plasmodium? Sporangia sessile, subglobose, 0·3 to 0·5 mm. diam., more or less confluent in small clusters 1 to 2 mm. across, dull red with iridescent membranous walls; where the sporangia are in contact their walls may be imperfectly developed and reduced to irregular strands and pouches. Capillitium a coil of smooth slender pale red threads, 1·5 to 3 μ diam., sparingly branched and with few free ends; one side of the thread is often bordered by a low ridge or wing. Spores in mass dull Venetian red, pale red when magnified highly, 10 to 11 μ diam., adhering in clusters of 8 to 14, more distinctly warted on the side facing outward as they lie in the cluster; the minute warts are flat-topped. Found on bark and lichen on the trunk of a living Persimmon tree, *Diospyros Kaki*, near Tanabe on the island of Kii, Japan, in August, 1917, by Mr. Kumagusu Minakata. The specimen consisted of four clusters of sporangia, two of which were slightly broken. It was sent under the name *Liceopsis*, a genus whose one species, *L. lobata* Torrend, bears a slight superficial resemblance to the form under consideration. This new species belongs without doubt to the family *Arcyriaceæ*, and shows affinity with *Perichæna*. It differs, however, from all species of that genus in the smooth capillitium and the æthalioid habit. I have much pleasure in naming the genus after its discoverer, who has rendered such distinguished service to science by his work on Mycetozoa in Japan; the specific name *longifila* refers to the character of the capillitium.

Explanation of Plate 558.

Fig. 1. *Physarum ovisporum*; two plasmodiocarps. 1 *a*. Capillitium. 1 *b*. Spores.

Fig. 2. *Arcyria carnea*; groups of sporangia. 2 *a*. Thread from the lower part of the capillitium. 2 *b*. Threads from the upper part of the capillitium, showing the prominences truncate or notched when seen in profile, together with two spores and a fragment of the sporangium-wall.

Fig. 3. *Minakatella longifila*; cluster of sporangia. 3 *a*. A group of confluent sporangia. 3 *b*. Capillitium and two spore clusters. 3 *c*. Fragment of æthalium-wall, to which are attached strands representing imperfect walls between the confluent sporangia. 3 *d*. Part of capillitium, showing a branching thread bordered by a narrow wing, and a cluster of spores.

GERANIUM PURPUREUM T. F. Forster.

By A. J. Wilmott, B.A., F.L.S.

The existence in this country of a distinct species allied to, but confused with, *Geranium Robertianum* has been demonstrated by C. Reid (as *G. modestum* in B. E. C. 1909, Rep. 429), and has been enlarged upon recently by Mr. A. H. Evans (in B. E. C. 1919, Rep. 724: 1920). There can be no question, to anyone who has seen the true *G. purpureum* Vill., that it is quite a distinct species, the small flowers with yellow anthers, the long-pilose pedicels and calyxes, and the ridged fruits, all being most clearly recognisable. My main criticisms of Mr. Evans's account are three. In the first place, I considered both the height and the habit of the two species identical when grown in my garden from seed supplied by Mr. Evans; secondly, I find it possible to identify the *G. purpureum* of Forster quite satisfactorily, regarding Syme, not Forster, as responsible for any confusion; I also consider that the name var. *rubricaule* Hornem. should not at present be used to replace var. *maritimum*.

It is not necessary here to say much about the true *G. purpureum* Vill. Villars originally included two plants under the name, one from Buis, the other from the Pont de Claix near Grenoble. The former was separated by Jordan in 1848 (in Adnot. Cat. pl. Jard. Grenob. 3, non vidi, ex Linnaea, xxiii. 511: 1850) as *G. Villarsianum*, a Mediterranean form which does not occur in these islands. The Pont de Claix plant was taken as the type of the emended *G. purpureum*; Jordan's account is to be found in Bull. Soc. bot. Fr. vii. 605 (1860), in a note read before a meeting of the Society at Grenoble, when Verlot exhibited dried specimens from the original locality. In the National Herbarium are good series collected by Verlot, labelled "*G. purpureum* Vill. rochers du pont de Claix, près de Grenoble," flowers collected in June 1867, fruits July 1866; with other identical series from the Bastille of Grenoble collected in 1860 and 1862, the former labelled "*Geranium purpureum* Vill.—Jordan! Bulletin de la Société bot. de France, session de Grenoble, 1860." In the following account, Jordan's description and Verlot's specimens are used as being the true *G. purpureum* Vill., emend Jord.

Comparing *G. purpureum* with *G. modestum* Jord. (in Bull. Soc. bot. Fr. vii. 605: 1860), the only points of distinction which Jordan himself found were "taille plus elevée, le port dressé, et . . . . les petales . . . de forme oblongue et d'un pourpre vif" of *G. modestum*, as contrasted with "port plus étalé . . . fleurs rosées-purpurines" of *G. purpureum*, the petal shape of the latter not being given. Rouy says that the petals of *G. purpureum* (*genuinum*) are also oblong. The differences are therefore slight, and the flowers of all the British specimens I have seen alive were more rose-purplish than bright purple, while the plants were stiffly erect; hence I agree with Grenier, who long ago (in Mem. Soc. Emul. Doubs) united the two.

Rouy, as I pointed out to Mr. Evans, made a mistake in referring *G. modestum* to the group with the fruits covered with thick weals instead of mere ridges. That group appears to be confined to the Mediterranean region, and I regard it as forming a third distinct species. *G. Villarsianum* Jord. emend., including *G. semiglabrum* Jord. ex Boreau and *G. mediterraneum* Jord.

G. Lebelii Boreau was distinguished from *G. purpureum* and *G. modestum* on account of its hairy fruits. I find that specimens of *G. purpureum* from the type-locality have the fruits sometimes glabrous and sometimes hairy (even on the same shoot), and Rouy states the same about *modestum*. The same is true of specimens from most of the British localities—a fact which occasioned trouble to critics in the Exchange Club Reports.

I have seen *G. purpureum* Vill. from the following localities:—*Cornwall*: Crantock, Newquay, Padstow, Wadebridge. *Devonshire*: Torquay (the rock walk), ? Holes Hole, Bere Ferris (T. A. Briggs collected some peculiar forms there, one of which, I think, may be true *G. purpureum*). *Dorsetshire*: Pimfield near Swanage (Ridley and Fawcett, 1882). *Somersetshire*: Leigh woods. *Channel Islands*: Jersey and Guernsey. *Waterford*: Dungarvan (Britten and Nicholson, 1882, correctly named *Lebelii*). *Cork*: on walls and on a cottage roof (Carroll). A weed in Chelsea Garden (Smith herb.!; this is *G. Robertianum* β, Fl. Brit. ii. 732: 1800). It is clearly a plant of southern distribution in this country.

We have next to consider *G. purpureum* Forster in E. B. Suppl. 2648, of which Evans says "He figured a plant which appears to be a small-flowered form of *G. Robertianum*; but the whole matter is so doubtful that Forster's *purpureum* would be best entirely neglected." The figure shows peculiar small flowers like those of *G. lucidum*, a glandular hairy calyx, and a strongly wrinkled fruit. The colour of the anthers is neither shown nor stated, but the other characters certainly indicate *G. purpureum* rather than *G. Robertianum*. The original drawing was first named "*G. Raii*," to which was added "*purpureum*" "W. B(orrer), Augt. 1, 1829." In the printed text we read: "the specimen here figured was communicated by Mr. Borrer, from Stokes Bay, Hampshire"; specimens from that locality are in Herb. Borrer at Kew and in Herb. Forster in the National Herbarium. These are certainly a form of *G. purpureum*, and the specimens from Borrer in Sowerby's herbarium confirm this determination. Forster also says "I have gathered it at Aberystwith, Cardiganshire." The specimen of this in E. Forster's herbarium has, however, the fruit and larger petals of *G. Robertianum*, and is near the var. *maritimum*; it should be collected again, as the material is very poor.

Attached to the Borrer specimens in Herb. Forster is a note from Borrer: "I have found this only at Stokes Bay and at Middleton near Bognor," and another, "*Geranium*—drawn by Sowerby as *G. Raii*. How Lindley's character applies I know not, nor whether this or the Shoreham one be Ray's plant." Hearing that Mr. J. E. Little had gathered a peculiar plant at Middleton in Sussex, and remembering Borrer's note, I immediately wondered if the long-lost *G. purpureum* of Forster had turned up again. I was able to visit the spot in 1919, when, on the bare shingle, I found two patches of plants identical with Forster's figure, the one about twenty yards long consisting of few specimens, the second, fifty yards long, with hundreds of plants. With the exception of a solitary specimen close up to the sand-hills at Littlehampton, I saw no others between Bognor and Littlehampton. The anthers were bright yellow, the fruits exactly as in typical *G. purpureum* (both glabrous and hairy forms were present), and the plant was clearly a prostrate form of *G. purpureum* analogous to the var. *maritimum* of *G. Robertianum* (the "Shoreham one" of Borrer). I was unable to find any tall and typical *G. purpureum* on the arable land close by the shingle. I have grown a prostrate maritime form of *G. Robertianum* in my garden, where it spread to the gravel paths and maintained itself unaltered for seven years. I therefore presume that this peculiar form of *G. purpureum* would do the same and name it as a distinct variety:—

Var. FORSTERI, nom. nov.; *G. purpureum* T. F. Forster in E. B. S. 2648 (1830), perhaps including Dillenius's synonym, but excluding Sherard and Villars; Babington, Man. ed. 3, 62, no. 12, γ (1851.)

G. purpurei typo caulibus brevioribus inter calculos maritimo decumbentibus plurimis rubentibus differt.

Babington's account shows quite clearly that he knew Forster's plant. The confusion among British botanists appears to have been due to an assumption that only one maritime Herb Robert could occur on the south-eastern coast, whereas there are at least four forms!

The other localities mentioned by Forster (Swanning in Dorset and Selsey Island) are based on plants gathered by Sherard (*G. saxatile robertiano simile anglicum* Sherard Schol. bot. 228; *G. lucidum saxatile foliis Geranii Robertiani* Ray Syn. ed. 2. 218: 1696) and by Dillenius (see Ray Syn. ed. 3, 358: 1724). These names, it is interesting to note, were cited by Villars himself as synonyms of his *G. purpureum*. The results of an attempt to elucidate them are given here.

Sherard's locality is "Swanning" in Dorset. The secretary of the Society of Antiquaries, who kindly tried to discover this name, could not find that it had ever been used for Swanage, but Mr. N. D. Simpson of Bournemouth kindly made investigations for me, and found that the old name for Swanage was Suanin, so we may assume that Sherard meant Swanage. I have already stated that typical *G. purpureum* grows in that neighbourhood, but it is not impossible that the var. *Forsteri* also may occur on the neighbouring shingle. As Sherard makes no mention of a coastal habitat it appears probable that it was the typical form which he had in view. By the kindness of Prof. Vines I was lent a sheet from Herb. Sherard bearing a ticket with Sherard's name: on the sheet are three plants, all of the glabrous Shoreham form with fruits of *G. Robertianum*, the only flower having the relatively small petals of that same form. There are three labels:—

A. "Geranium saxatile Robertiano simile Anglicum Sch. Bot. 228. Geranium lucidum saxatile foliis Geranii Robertiani Rai Syn. 284......(?) 268. Geranium Robertianum laciniis ex visore lucidum brevibus rostris Pluk. Alm. 168": in Sherard's writing.

B. "On ye coast of Sussex": in Dillenius's writing.

C. "Geranium Robertanium n^r^ E. Sib."

But none of these plants can be regarded as authentic for Sherard's name, for it is not clear to which specimen the Sherard label applies. Labels B. and C. are one at each bottom corner, with a specimen above each, but the third specimen might belong not to A. but to B., and it is clear that A. has been added after C. for it covers a considerable part of the specimen. As there is no evidence that any of the three plants came from "Swanning," I cannot regard them as showing that Sherard did not intend *G. purpureum*.

In the third edition of Ray's *Synopsis* the following is added; "On the shore of Selsey-Island plentifully; D. Dillenius, in company with Mr. Manningham." Prof. Vines also lent me the sheets in Dillenius's herbarium, but I found no specimens from Selsey. There is, however, no reason why Forster's plant, which occurs at Stokes Bay (not refound since Borrer) and Middleton, should not also occur round Selsey Bill (the "Island" refers doubtless to the area surrounded by the water of the sea and maritime ditches). Further, Forster states that Borrer "has also lately observed it (the var. *Forsteri*) in Dillenius's station," and since we know that Borrer knew Forster's plant apart from *G. Robertianum* var. *maritimum* ("the Shoreham one") we may be justified in assuming that Dillenius's plant was the var. *Forsteri*, although I found no voucher specimen in Herb. Borrer. Will some botanist make a careful search for it there?

I have searched the Sloane Herbarium for evidence, but without success. The Ray name is attached to a water-colour sketch (no. 133) by Ehret (fl. 1740–70) in the Department of Botany, but as the origin of the specimen is not given it may be here ignored, although I have not seen a Herb Robert which would exactly match it. The Ray name is also to be found in the Solander MSS. as a synonym of "*G. saxatile*" from "in rupibus Scti. Vincentis prope Bristol and in collibus maritimis Angliæ, Alchorne." The "tota planta glabra" indicates that the St. Vincent's Rocks plant was probably the peculiar glabrous limestone form of *G. Robertianum* which occurs at Cheddar (E. S. Marshall, no. 3910, see B. E. C. 1913, Rep. 462, &c.) and in Derbyshire, which has at times been wrongly named *purpureum* and *modestum*. The Alchorne maritime plant would be the var. *maritimum*, with which the glabrous limestone form is almost identical except in its very slightly hairy fruits. It should be mentioned that normally hairy forms also occur on the limestone screes in Somerset and Derbyshire. The glabrous form requires further study.

It is possible that the Raian name may refer to *G. Raii* Lindley (Syn. 57 : 1829) should there be a distinct form corresponding to that name! Lindley's meagre description, placed between *G. Robertianum* and *G. lucidum* is "stalks 2-flowered, shaggy. Fruit wrinkled, simply keeled . . . . (Ray synon.). On the sea-coast in the South of England. Annual, June, July." The statement that the stalks and calyx were shaggy would appear to indicate Forster's plant (N.B.: the "calyx with 10 angles" and "fruit wrinkled" may be ignored, as *G. Robertianum* is similarly described). But *G. Raii cannot* be *G. purpureum* Forster, since both at Cambridge (Herb. Henslow) and at Kew are plants labelled by Lindley "G. purpureum Eng. Bot. nec G. Raianum, Lindl. Synops.," from the "Sussex coast," "Lindley, 1830." These are, indeed, *G. purpureum* Forster, although Prof. Moss has erroneously labelled both of them *G. Robertianum* var. *maritimum* Bab. Unfortunately Lindley appears to have left no specimen to show what actually *was* his plant.

It is just possible that Lindley may have intended the form which I long grew in my garden from the shore E. of Pevensey. This has glabrous carpels like the Shoreham form, but the pedicels and calyx are glandular hairy, the calyx densely so (though scarcely "shaggy"). The flowers in some herbarium specimens are often small, as in var. *maritimum*: after several years' cultivation in my garden the flowers were as large as in the typical form, but I have no notes as to their size on the original parents. The anthers of the plant in my garden were a yellower (less red) orange than the type, and the carpophore extremely stout (1·5 mm. instead of 1·0 mm.), but this latter character has not been noticed on herbarium specimens of this form. It is the *G. Robertianum* var. *modestum* of Arnold's Fl. Sussex, ed. 2, 24 (1907), at least in part, the portion of Herb. Roper which contains most of the specimens referred to by Arnold being kindly lent me by Mr. Roberts, the Director of the Brighton Museum. This form remained absolutely constant in prostrate habit, coloration, preference for the gravel paths, etc., until *G. Robertianum* and *G. purpureum* were introduced into the garden, when intermediate forms (? hybrids) occurred. As it remains constant from seed and is intermediate between the type and var. *maritimum* it may be called var. *intermedium*. I have seen it from Dorset (Chesil beach, Riddelsdell, 1912, see B. E. C. 1912, Rep. 240): Somerset (Porlock, E. S. Marshall, 3174); Devonshire (Lynton Foreland) and Glamorgan (Barry).

A form with the same habit, small narrow segmented leaves, etc., but with fruits as hairy as in the type, occurs at Kingsdown and is the plant mentioned by Syme under *purpureum* (specimens in H. M. B.): the same appears to grow on the seashore in Arran (A. Ley, leg. 1883, as var. *modestum*). I have seen what appeared to be typical *G. Robertianum* straggling on bare shingle in E. Sutherland (near Dunrobin), becoming reduced and procumbent but with normal flowers; and similar plants occur in Shetland (stony shore near Boddam, 1890, Beeby). The Kingsdown plant (which has small flowers) may therefore be merely an extreme state of the type occurring on shingle, but the relationship of all these can only be settled by cultivation.

The var. *hispidum* Druce in B. E. C. 1916, Rep. 406 (seen in Herb. Barton), from Berry Head, Devonshire, is remarkably hairy. Could this be *G. Raii* Lindley ?

The var. *maritimum* Bab. Man. ed. 3, 62 (1851), refers in particular, to judge from his herbarium, to the Shoreham form, to which it is here restricted. I have gathered this in quantity on Shoreham beach, where it is astonishingly uniform. The shoot is usually (not always) very red, sometimes practically red all over, the leaves smaller than in type, with narrower and more distant segments. The whole plant is almost glabrous, sub-eglandular, the petals 8 (–9–10) mm. long, rather narrowly obovate, the carpels very pale yellow-brown, ultimately pale tawny, always *quite* glabrous, with a single wrinkle (excluding the apical crest) or rarely a second reticulation deep enough to be called a wrinkle, the reticulations few, about 4 (3–5) arising from each side of the keel. This appears to be the commoner shingle form in Sussex, and is the var. *purpureum* of most English botanists; I have also seen it from Dorset, Somerset (E. S. M. 3344), Glamorgan. It is remarkably like the glabrous limestone form, except that the latter has a darker-coloured (? smaller) fruit with a few hairs to be seen on it under high magnification.

Hornemann's account of his var. *rubricaule* (in Dansk Œc. Pl. ii. 226: 1837) is "var. Red-stemmed stinking Cranesbill (*Geran. Robertianum rubricaule*) with widespread, at the joints swollen, red-shining stems. This is often found on broad sea-beaches (Strandbredderne) between pebbles." (I give a literal translation, as I am not well versed in the Danish language.) I learn from Copenhagen that no authentic specimens are traceable in Herb. Hornemann ; it is therefore impossible at present to refer this name to any shingle form in particular, and it must therefore be neglected, although var. *maritimum* may have been the plant intended. Lange, in Willk. & Lange, Prod. Fl. Hisp. iii. 531 (1878), includes under it both rock forms and seaside forms in Spain (possibly var. *maritimum* and the glabrous *limestone* plant ?); while Rouy (Fl. Fr. iv. 94: 1897) merely treats it as the red-stemmed form of the type. This latter view is erroneous: see Smith (Fl. Brit.: 1800), "Herba autumno saturate rubet," and Ray (Hist. 1058: 1688) "Robertianum a rubore caulium & florum dictum creditur."

Rouy's "var. *littorale*" of the "Forme *G. purpureum*" (op. cit. 97 & 98) refers entirely to a plant occurring on the maritime shingle between Cayeux and le Hourdel (dept. Somme), evidently as well known to French botanists as is the Shoreham plant to us. I have so far been unable to obtain specimens; it will doubtless be one of our south coast forms, probably actually the var. *maritimum* Bab. It is, of course, not a form of *G. purpureum*, as the "petales une fois plus longs que le calice" indicates, while the "rarement presque orangées" added to the "anthères jaunes" in the description of *purpureum* was presumably added for the benefit of this *G. Robertianum* form.

The *G. scopulicolum* Jord. in Billot exs. 3549, nomen nudum; Rouy, op. cit. 97, as subvar. of *purpureum* var. *genuinum*—a plant from the cliffs of Glanville,—is certainly a form of true *G. purpureum*, but does not seem to be the var. *Forsteri*. I cannot separate the few specimens I have seen from the typical form, as Rouy's characters do not seem constant.

Before giving an analysis of Syme's account, I will give a list of the various forms:—

1. *G. Robertianum* var. *genuinum* Syme. With glandular and jointed hair fruits dark brown and always downy. ? Growing also on shingle.

2. Kingsdown form, procumbent on shingle as above, but flowers smaller and leaves with narrow segments as in var. *maritimum*.

3. Glabrous limestone plant. Straggling, fruit almost but not quite glabrous, shoot quite glabrous. Flowers often small.

4. Var. *intermedium* mihi. Peduncles and calyces glandular hairy, fruit glabrous. Plant prostrate, leaves like 2.

5. Var. *maritimum* Bab. Usually quite glabrous, fruit light brown, quite glabrous, flowers small, otherwise like 3 and 4.

6. Var. *hispidum* Druce. Densely hispid all over. Flowers not seen. Fruits small, dark vandyke-brown, nearly or (?) quite glabrous.

Var. *celticum* (Ostenfeld in B. E. C. 1919 Rep. 551: 1920) appears to be another form which breeds true, coming between type and no. 3 above.

7. *G. purpureum* Vill. emend. Jordan.

8. Var. *Forsteri* mihi.

Syme (Eng. Bot. ii. 203: 1864) distinguishes three varieties—var. *genuinum* (the normal form of *G. Robertianum*), var. *modestum*, and var. *purpureum*. It is clear from his description that his var. *modestum* is what is here called *G. purpureum*, for he says its "calyx has the long woolly . . . . hairs of *G. Robertianum*, var. α, though longer and more abundant than in that form. The carpels, however, are glabrous, and with the wrinkles forming scarcely any meshes; the petals are smaller, and of a deeper rose-colour." The localities given are "on the shingly beach at Grand Cobo, Guernsey," where Syme had himself gathered it, and Torquay, sent him by Mr. C. Eyre Parker. *G. purpureum* grows in both of these districts and there is therefore little doubt that Syme both knew *G. purpureum* and that he intended it by his var. *modestum*. (I have not seen herb. Syme.) Symes's account is therefore quite sound, except that he cites as doubtful synonyms *G. Raii* Lindley and *G. Robertianum* var. *maritimum* Bab. He indicates in a footnote that he knew nothing of either of these plants, so their inclusion signifies nothing. It is evident that Syme did not understand Babington's use of the term "wrinkled," but included as wrinkles the fine reticulate lines also. These lines cannot be properly termed "wrinkles," and the fruits of *G. Robertianum* and the var. *maritimum* have only one or two wrinkles at the top of the fruit, whereas those of *G. purpureum* have them much more numerous. Naturally Babington, to distinguish his β from his γ, both shore plants, mentioned that in var. *maritimum* the fruit was wrinkled only at the top, doing so not to distinguish it from typical *G. Robertianum* but from *G. purpureum*.

But it is in Syme's account of "var. *purpureum*" that we find the whole source of confusion. He says it "is common on shingle in the south of England; I have found it near Kingsdown, Kent, and at Shoreham, in Sussex," and cites Vill. and E. B. S. 2648. It is the Shoreham form that was mainly intended, for he describes it as "subglabrous, with the pedicels and sepals rather sparingly glandular-pubescent" (the latter part being probably due to his inclusion of the Kingsdown plant). In this sense the name has been used (see National Herb.) by Newbould, Trimen, Marshall, Hilton, and Riddelsdell, etc.); but why Syme was unable to perceive that the Eng. Bot. figure was almost exactly like the plant he had gathered in Guernsey and named *modestum*, I find it impossible to imagine. In the footnote referred to above he says, "As Dr. Lindley speaks of his *G. Raii* having the calyx shaggy, I suppose it must be referred to var. β instead of var. γ." Yet the E. B. figure of *G. purpureum* has a very hairy calyx and for that same reason should have been correctly placed to the var. *modestum*. Syme also says "The carpels resemble those of var. β, but are more closely wrinkled . . . ," which is the exact opposite of what the plants he had himself gathered would have shown had he examined them again. He adds "This is certainly the plant represented in Forster's 'English Botany' Supplement as *G. purpureum*"; it certainly is nothing of the kind, but the position in regard to both Syme's account and the plants themselves should in future be quite clear.

In conclusion, a note on *G. Robertianum* × *purpureum*. The heavy frosts of 1918–9 exterminated all the *G. purpureum* (a southern plant) in my garden, and in 1919 only *G. Robertianum*, the var. *intermedium*, and intermediates between these, were to be found. To my surprise, in 1920 plants with small flowers as in *G. purpureum* reappeared, some of them with characters intermediate between it and *G. Robertianum.* Presumably the hardiness and other characters of *G. Robertianum* were dominant over the *purpureum* characters in the F 1 hybrid, the masked recessive *purpureum*-characters reappearing in 1920 as the result of segregation. Possibly also some seeds had lain dormant, but I feel rather doubtful whether they do so.

A NEW EUROPEAN EPIPACTIS.

By Colonel M. J. Godfery, F.L.S.

In 1868 Hermann Müller exhaustively described and figured *Epipactis viridiflora* Rchb. (Verh. N. H. Vereines der preuss. Rheinlands). He stated that the stigma is turned so far back that its upper half stands under the anther, that nothing is to be seen of a rostellum, that the pollinia are deposited erect on their bases on the front of the stigma, and that self-fertilisation is inevitable. I was much puzzled to find that, in spite of these fundamental differences, continental writers were almost unanimous in regarding *viridiflora* as a mere variety of *latifolia.* Did they doubt Müller's accuracy, or was his paper not widely known?

In June 1920 I went to Thorenc, above Grasse, where *viridiflora* was said to be common, and to flower, according to Camus, a month earlier than *latifolia.* I was surprised to find its floral structure was exactly the same as that of *latifolia.* The stigma was in the same position, the rostellum well developed, and the rapidity with which the pollinia were removed from large numbers of flowers showed that it was well visited by insects. Evidently this was not Müller's plant. I sent specimens to Mdlle. Camus, asking if they were really the *E. latifolia* sous-espèce *viridiflora* of the Mon. Orch. de l'Europe, of which she was joint author with her father. She replied that such was the case. Later Dr. Keller, of Aarau, kindly sent me specimens of the Swiss *viridiflora.* In these the rostellum was so effective that I found the greatest difficulty in opening a bud without withdrawing the pollinia, through the viscid disc adhering to the base of the epichile. Barla's figure of *viridiflora* much resembles the Thorenc plant, and he shows the pollinia attached to a well-developed rostellum. In all these cases the floral mechanism is identical with that of *latifolia.*

Among a number of the Thorenc *viridiflora,* gathered during the previous three or four days, I found a single specimen of what I at once saw must be Müller's plant. No rostellum was visible, and the small pyramidal pollinia were standing erect on their bases on the front of the stigma. I could not remember where I had found it, and for the next fortnight searched feverishly in every direction for further specimens, but in vain. At last, in a small pine-wood intersected with paths quite close to the hotel, I found ten fine specimens, and thought that I had now got the true *viridiflora.* From these I compiled the following comparison of Müller's plant with *latifolia* (including Camus' *viridiflora*). It should be carefully noted that the flower is supposed to be held upright, as in Müller's figures. This, of course, is not the natural position of the flower, which is horizontal or drooping, but it is convenient for description.

The *stigma* in *latifolia* is vertical, almost parallel with the axis of the flower, facing forwards, its lower lip slightly turned upwards, and is somewhat concave. On looking into a flower it is at right angles to the line of vision, and its quadrangular shape is well seen. In Müller's plant (*Epipactis*) it is horizontal, at right angles to the axis of the flower, the upper portion thrust well *beneath the base of the anther*, nearly reaching the back wall of the column, the lower part curving downwards; it faces upwards, and is convex. In front view it is parallel with the line of vision, and appears crescent-shaped, as shown in Müller's figure.

The *rostellum* in *latifolia* is large. Müller says that in his plant there is no rostellum. At first I thought this was the case with the Thorene plant, but later I found that if the anther is turned back on its hinge, there is, at any rate in bud, a glistening conical projection, which has the appearance of a not fully developed rostellum, in the middle of the upper edge of the stigma; if touched, weak strings of viscid matter adhere to the touching object. It is entirely concealed beneath the anther, for the stalk of which I at first mistook it. Müller's fig. 11 shows a rounded projection in exactly the same position; perhaps he failed to recognize it as a rudimentary rostellum, for it may have been less developed in the Westphalian plant.

A *clinandrum*, or shallow cup, occupies the summit of the column in *latifolia*, bounded on the back and sides by the walls of the column, and in front by the back of the stigma. The anther leans forward over this cup, and when its cells open, the pollinia are deposited in it, lying on their sides. In Müller's plant there is no clinandrum, the corresponding space being roofed over by the stigma.

The *anther*, in *latifolia*, seen from the side, is narrow at the base, broad and truncate at the apex, appearing rhomboidal; it is hinged to the back wall of the column, and its base is separated from the stigma by the whole diameter of the clinandrum. In Müller's plant, however, it is shaped like a cap of liberty, its hinge is in front of the back wall of the column, and its semi-circular base projects well over the upper part of the stigma. On dissecting a very young bud, expecting to find the pollinia *in situ* within their cells, I found to my surprise, that they were already outside the anther and enclosed in an extremely thin tight-fitting and very glossy membrane. They were so much larger than the openings of the anther-cells that it was clear that they could not have passed through them except at a still earlier period, when they were much smaller. The membrane appeared to be continuous with the cell-walls. Looked at from beneath, there was a funnel-shaped channel between the anther and the pollinia.

The *pollinia* in *latifolia* are club-shaped, their thick ends rounded, their thin ends pointing forwards, firmly attached to the rostellum. In Müller's plant they are smaller, shaped like a sugar-loaf, with flat circular bases and curved sides tapering to an obtuse point. Even in bud they stand upright on their bases on the front surface of the stigma, and if removed leave two circles of pollen on the stigma, the diameter of each free from pollen, for they are cleft in two at the base, though undivided at the apex. It will thus be seen not only that every one of the reproductive organs in Müller's plant differs from the corresponding one in *latifolia*, but that they are arranged and co-ordinated on a different plan. Self-fertilization appears to be inevitable, but in *latifolia* the pollinia are transported by insects.

Is Müller's plant the true *E. viridiflora* Rchb., or are continental botanists right in regarding the latter as a subspecies, race, or variety of *latifolia*? Reichenbach's description (Flor. Germ. Excurs. p. 134) is as follows:—

"*E. viridiflora* (*Serap.*) Hoffm. Foliis elliptico-acuminatis amplexicaulibus, labio cordato-ovato acuto plano, petala sepalaque lanceolata ovario oblongo longiora aequante. *Serapias latifolia* b. *sylvestris* Pers. *Serap. latifolia* Fl. dan. 811. Pedalis, vaginae arctae praecedentis [*E. latifolia*], folia omnesque reliquae partes magis elongatae tenuioresque ut ortum e locis umbrosis indicent; flores virides plus vel minus rubicundi."

English botanists will recognize the source from which Babington drew his description of *E. media* Fries. It will be seen that, with the exception of the longer acuminate leaves, and the "labio plano," there is no character given to distinguish the plant from *latifolia*. The younger Reichenbach was unable to accept his father's view as to the specific rank of *E. viridiflora*, though he must have considered its claim thereto very carefully. His *Icones*—a wonderful monograph of European orchids—show that he was interested in the reproductive organs and frequently figured them. He closely studied *viridiflora*, for he wrote a much fuller description of it than his father, but he says not a word about the absence of a rostellum or the unique position of the stigma (both of which characters are obvious at a glance, and in marked contrast with *latifolia*), nor does he mention the different shape of the anther and of the pollinia. His silence is capable of only one reasonable explanation; his *varians* (*viridiflora*) was not Müller's plant, and did not exhibit its characters. Continental authors are therefore right in regarding *E. viridiflora* Rchb. as a form of *latifolia*. Without suspecting it, Müller was dealing with a hitherto unnamed species, and was mistaken in identifying it with *E. viridiflora* Rchb., a very natural error, for Reichenbach's description, as far as it went, agreed very well with his plant, and it was clear that the latter did not belong to any other known species of *Epipactis*. It would therefore seem to him that it must be *viridiflora*.

Ascherson and Graebner (Syn. Mitt. eur. Flor. p. 862) are the only authors, as far as I know, who mention that *viridiflora* has no rostellum, and is self-fertilised. I have ascertained that they did so solely on the strength of Müller's paper, and not from study of the living plant.

It therefore seems best to restrict the name *viridiflora* to the variety of *latifolia* to which it was originally given and is now almost universally applied, and to give the name *E. Muelleri* to the plant brought to light by his researches.

The only doubt in my mind is, not whether *E. Muelleri* is a distinct species, but whether it does not constitute a separate genus. It must be admitted that differences in the structure and co-ordination of the reproductive organs furnish generic rather than specific characters. But it is manifestly undesirable to create a new genus except on quite unassailable grounds, and the whole facies of the plant is so exactly that of an *Epipactis* that it seems preferable to widen our conception of that genus rather than to found a questionable genus on a single type.

Dr. Rudolf Schlechter is against the creation of a new genus, but reserves his opinion as to the question of specific rank. He is inclined to regard *Muelleri* as a biological variety of *E. latifolia*—that is to say, that it is *latifolia* modified for self-fertilisation. It is easy to conceive that an *Epipactis* could become self-fertilising through the pollen becoming very friable and falling into the flower, as in the English *E. viridiflora* var. *dunensis*, or through the pollinia sliding over the upper edge of the stigma as in *leptochila* (Journ. Bot. 1920, p. 33) and in *microphylla*, but it is hard to believe that modification of each individual organ, and their co-ordination on a different plan, should be either necessary or probable to secure a result which has actually been so much more simply attained in the above species of *Epipactis*.

Darwin showed that cross-fertilisation is superior to self-fertilisation: "It is hardly an exaggeration to say that Nature tells us in the most emphatic manner, that she abhors perpetual self-fertilisation" (Fert. Orch. 1890, p. 293). He explains the self-fertilisation of *O. apifera* and *E. viridiflora* as probably due to their being threatened with extinction through lack of insect visits, and indeed it is hard to believe that a cross-fertilised plant should be modified for self-fertilisation without some cogent reason of this kind. But why should *latifolia* need to become self-fertilised? It is the most abundant and widely spread of all species of *Epipactis*, and is unusually well visited by insects. Why should it give up successful cross-fertilisation for an admittedly inferior method? We are met at the outset by an inherent improbability. Further, if *Muelleri* is a biological variation of *latifolia* with a view to increased fertility through self-fertilisation, it has entirely failed, at any rate at Thorenc, to bring about this result. It is restricted to one small wood in the midst of an immense area of similar woodland. Persistent search throughout the whole of its flowering-season only produced eleven specimens, while it was surrounded on every side by hundreds of flourishing *latifolia*. When an insect-fertilised plant, such as *O. apifera* or *Cephalanthera pallens* becomes mainly self-fertilising, it usually grows in considerable numbers, and is often very abundant, as might be expected from a plant in which nearly every flower produces a capsule. Is any instance known of an orchid in which the self-fertilised form is rare, and the cross-fertilised plentiful? *Muelleri*, at Thorenc, appears much more like the remnant of a disappearing species than a plant seeking to raise its numerical standard by the adoption of self-fertilisation. It suggests a case of arrested development.

If *Muelleri* were originally *latifolia*, and the stigma began to turn backwards with a view to self-fertilisation, an early result would have been that the rostellum would be withdrawn beyond the reach of visiting insects, and cross-fertilisation would immediately cease. This would be disadvantageous to the plant, and, if it occurred before self-fertilisation were fully assured, might cause its extinction. Variation, however, to be maintained and increased, cannot be harmful to the plant, or natural selection automatically puts an end to it.

Even supposing that the stigma did move backward, like a roller-blind, over the clinandrum, so that the pollinia were deposited direct on its viscid surface, these would lie on their sides, as in *latifolia*. In *Muelleri* they stand erect on their bases, a very much *smaller area* thus coming into contact with the stigma. To bring this about there must have been a concurrent modification of the anther also. How can we conceive that the anther should have been modified so as to cause the pollinia to stand on their bases, when it would clearly be more advantageous for them to continue to lie on their sides? Moreover, full self-fertilisation would have been attained as soon as the stigma had moved far enough backwards to receive the whole of the pollinia. Why should the backward movement continue till part of the stigma is thrust well beneath the base of the anther, where it is out of action? If Dr. Schlechter's suggestion is correct, *latifolia*, in changing into *Muelleri*, has sacrificed an extremely efficient system of cross-pollination for an inferior method, and has further carried its modification so far that its self-pollination is less effective than it would have been if the variation had been arrested at an earlier stage. From a biological point of view the hypothesis that *Muelleri* is a self-fertilising form of *latifolia* appears to present insuperable difficulties.

If *Muelleri* is a variety of *latifolia*, we might reasonably expect to find intermediate forms. I could find nothing of the kind at Thorene, except one plant which had the short ovate leaves of Camus' *viridiflora*, and may possibly have been a hybrid with it, though, in view of the extensive leaf-variation in *latifolia*, I put it down to a similar cause. Müller mentions an intermediate specimen from Driberg, apparently the only one found. This absence of intermediate forms is in strong contrast with *E. latifolia* var. *viridiflora*, in which they are said to be so numerous and variable that it is often difficult to decide whether a particular plant belongs to the type or the variety.

Even assuming that *Muelleri* arose by variation from *latifolia*, the marked differences it now exhibits, if permanent, appear sufficient to justify its claim to specific rank. Dr. Schlechter has seen my figures of the column, which he said in every way showed the same characters which had already been pointed out to him in the case of German specimens. They therefore appear to be constant in such widely separated areas as Germany and the South of France. It seems scarcely in the interests of exact science to regard two plants, showing marked and constant differences in the essential parts of the flower, as belonging to one and the same species. Is it not rather a case of essential differences masked by a superficial outward resemblance?

Epipactis Muelleri, sp. nov.

Rhizoma nodosum, nodis superioribus sæpe gemmiparis. *Caulis* pubescens. *Folia* lanceolata vel ovato-lanceolata, internodia plane excedentia. *Bracteæ* lanceolatæ, 14-nerves, summa quam ovarium brevior. *Ovarium* anguste pyriforme, puberulum. *Sepala* lateralia ovato-lanceolata carinata tertio lanceolato latiora. *Petala* lanceolata, obtusa. *Labellum* sepalis brevius; hypochilium latum, subtus 5-nerve; epichilium antrorsum spectans nonnunquam reflexum, triangulare, obtusum. *Stigma* quadrangulare, cum floris axi angulum rectum efficiens; *rostellum* omnino vel fere obsoletum. *Clinandrium* 0. *Anthera* conoidea, basi semicircularis, super stigma eminens. *Pollinia* parvula, conoidea, obtusa.

Rhizome knotted, descending, deep, upper knots often bearing buds. *Roots* slender, wiry. *Stem* 20–43 cm., woody at base, pubescent, especially above, basal sheaths brown-ribbed and torn. *Leaves* ovate-lanceolate to lanceolate, much longer than internodes, stiff, springing back when displaced. *Bracts* lanceolate, lowest $4\frac{1}{2}$ cm. × 8 mm., 14-nerved, uppermost shorter than ovary. *Ovary* pear-shaped, slender, with scattered short hairs, ± 1 cm. long, stalk ±5 mm. Side *sepals* ovate-lanceolate, keeled, 3–5-nerved, green, rather obtuse. Upper sepal lanceolate, narrower. *Petals* lanceolate-obtuse, 5–7 nerved, pale whitish green. *Lip* shorter than sepals (8 × 5 mm.), hypochile shallow, 5-nerved beneath, pale green, edges rose, brownish rose within, with drops of nectar; epichile triangular (±5 × 4 mm.), obtuse, whitish faintly tinged with rose, centre greenish, with a rose-coloured ridge down the middle, calli obscure, rose. Epichile directed forwards, sometimes reflexed.

Stigma quadrangular, at right angles to axis of flower, the upper part thrust beneath the base of the anther, the lower curving towards the lip. *Rostellum* rudimentary, concealed beneath the anther, or none. *Clinandrum* none. *Anther* conical, base flat semi-circular, projecting over stigma, apex obtusely pointed and curving forward. *Pollinia* small conical obtuse, standing erect on their bases on the viscid stigma.

A MOUNTAIN FORM OF CAREX PULICARIS.

By H. W. Pugsley, B.A., F.L.S.

On several occasions in recent years I have met with a form of *Carex pulicaris* on mountain cliffs in Great Britain which, when growing, differs appreciably from that species as usually seen in lowland habitats, and does not appear to have been hitherto distinguished. *C. pulicaris*, the Flea Sedge, is typically a well-marked plant, especially characterized, as the fruits of its androgynous spikelets ripen, by the fall of the lower bracts and the peculiar reflexing of its perigynia, affording a fanciful resemblance to a number of fleas settled on the stem. It is well known as an inhabitant of bogs, moist heaths, and marshy meadows throughout a large part of Europe.

So far as I have been able to trace, no varieties of *C. pulicaris* have been admitted in any modern European Flora, or in Boeckeler's *Cyperaceen*, and one variety only (*β. cæspitosa*, which is not montane) appears in Kükenthal's account of the genus in the *Pflanzenreich*. Most of the published figures usually consulted depict the typical plant. *Flora Danica*, i. tab. 166, it is true, shows a narrow spikelet with erect perigynia, but this is clearly drawn from a plant not yet in fruit. The plate of *English Botany*, no. 1051, portrays a dwarf form with spreading perigynia, to which a fruiting spike, where they are characteristically reflexed, was added for the third edition. In Reichenbach's *Icones Fl. Germ.* viii. tab. 195, a dwarf plant with erect perigynia, which may represent our montane form, is drawn by the side of the typical species, but is not referred to in the text. Kükenthal remarks that *C. pulicaris* inhabits swampy fields up to the alpine region, but the only definite allusion to it as a montane species that I can find is in Buchanan White's *Flora of Perthshire*, where it is stated to grow in boggy places and alpine rock-ledges, reaching 2900 feet.

My first experience of an unusual form of this plant occurred in July, 1910, when I collected, as I thought, *C. rupestris* Bell. in two localities near Braemar, viz. the Little Craigindal and Glen Callater. On my return home, however, I was surprised to find that my specimens from the latter locality belonged to *C. pulicaris*, and that I had mistaken them, when growing, owing to their habit being dwarfer and less tufted than usual, and their perigynia uniformly erect instead of deflexed at maturity. Mr. C. E. Salmon tells me that he was similarly deceived in 1912 in Glen Dole, and I learn through Mr. Arthur Bennett that the late E. S. Marshall gathered this form for *C. rupestris* in 1888 and noted that in habit it was unlike *C. pulicaris*. On the 10th July, 1915, I again saw this plant in abundance and showing well-developed spikelets on the dry rock-ledges of Craig-na-lochan, near Ben Lawers, and a week later on Ben Laoigh; but though I carefully searched, in neither place could I find any perigynia that showed signs of reflexing. Subsequently I have met with exactly the same form on the cliffs of Snowdon and Twll Du in the month of June, and on the north side of Ben Nevis in July.

The confusion of this dwarf erect-fruited form of *C. pulicaris* with *C. rupestris* is due to the similar size and habit of the two plants, and to their occurrence in similar situations. But the likeness is merely superficial, for not only has *C. rupestris* 3 instead of 2 styles, but its perigynia are much shorter and quite differently shaped.

The mountain form of *C. pulicaris* has really a much closer affinity with the Pyrenean species, *C. macrostyla* Lapeyr. Hist. Abr. Pyr. p. 562 (= *C. decipiens* J. Gay), which, though closely allied, differs from any form of *C. pulicaris* chiefly by the fewer male flowers of its spikelets and its narrower, more beaked perigynia, which never become reflexed.

As the principal points of distinction of this montane *C. pulicaris*, as I saw it in life, were the persistency of its bracts and the lack of reflexion of its fruits, I have been at some pains to ascertain how far these characters are constant. In British examples of the typical species the perigynia are sometimes fully developed and reflexed by the middle of June and are generally in this condition before the end of July, by which date I have never seen reflexed perigynia in any of the montane plants observed *in situ*. The British material at Kew and South Kensington is scanty and throws but little light on the question, there being one small specimen in Herb. Mus. Brit. (*Wight*, Clova Mts., 1834) with deciduous bracts and deflexed perigynia, which may be the montane form, while one at Kew (*Croall*, Pl. of Braemar, no. 251, July, 1855) shows the perigynia erect. In the collection of Mr. C. Bailey, however, is a tuft from Glen Callater, obviously the mountain plant, collected 10th September, 1864, which has the bracts fallen and the perigynia irregularly spreading or reflexed, and another from Twll Du, dated 27th July, 1876, that is very similar. It therefore appears that the perigynia do not remain erect till they fall, but that they eventually reflex as in the type, though to a less degree and much later in the season.

In other respects this form of *C. pulicaris* shows minor differences such as may be expected from its mountain habitat. It is relatively dwarf, 10–12 (rarely 15) cm. instead of 15–20 (rarely 30) cm. in height, and is often much less cæspitose, probably owing to its growth in narrow rock-clefts. Its spikelets are rather shorter and bear fewer flowers, the female commonly less than eight; and the fruiting perigynia appear, on an average, a little shorter and less attenuated than in lowland examples.

These differences seem to be the direct results of environment and insufficient to justify varietal distinction, but, viewed with the erect perigynia, they give the plant during a considerable part of the summer a facies of its own which may warrant separation as a form. This may be diagnosed thus:—

CAREX PULICARIS L., b. MONTANA, forma nova.

Planta typo humilior sæpius laxe cæspitosa culmis 10–12 (rarius 15) cm. altis prædita. Spiculæ paulo breviores floribus paucioribus vulgo sub-8 femineis. Perigynia fructifera verisimiliter quam in typo nonnihil breviora minus attenuata, diu erecta sed tandem patentia vel irregulariter deflexa, ubi bracteæ cadunt.

This form is known in Britain from Glen Callater, S. Aberdeen (alt. 2700′)! Glen Muick, S. Aberdeen, *T. R. Sim* in Hb. C. Bailey; Glen Dole, Forfar (2000′), *C. E. Salmon* in Hb. Mus. Brit.; Glen Fee, Forfar (2300′), *E. S. Marshall* in Hb. A. Bennett; Ben Nevis, Westerness (2500′)! Craig-na-lochan, Mid Perth (2000′)! Bein-Dubh-Chronzie, Mid Perth (2000′), *E. S. M.* in Hb. A. Bennett; Ben More, Mid Perth (2000′), *E. S. M.* in Hb. A. Bennett; Ben Laoigh, Mid Perth (2000′)! Clogwyn dur Arddu, Snowdon, Carnarvon (2200′)! and Twll Du, Carnarvon (1800′)! A small example in Herb. Kew from Helvellyn, collected by Bentham in 1823, probably belongs here also; and likewise an Irish specimen in Herb. C. Bailey, collected by Dr. Druce on Mangerton, Co. Kerry, in August, 1875.

With the Continental material at Kew are two Pyrenean specimens, gathered in 1822 and 1825, and labelled "*C. pulicaris?*" by Bentham, that seem referable to this form, and a third example in good condition, labelled "Marais à Gèdre, Htes. Pyrénées, Bordère, Juin, 1873." Two plants in Herb. Mus. Brit., one from the younger Reichenbach (Heller, Dresden), and the other from Gaudin (A la Tour de Gourze, supra la Vaux), show the same habit and erect perigynia; and a third Norwegian example received from Vahl is probably identical. This material indicates that this form is to be found in mountainous districts throughout the range of the species.

It may be added that *C. pulicaris* has long been known to grow on the dry limestone downs at Clifton, Bristol—a strange habit for a bog-loving species—and specimens from this locality in Herb. C. Bailey show some resemblance to the montane form.

THE BRITISH SPECIES OF MILESINA.

By W. B. Grove, M.A.

During February of the present year, Mr. D. A. Boyd has sent me from the neighbourhood of West Kilbride, Ayrshire, from two localities several miles apart, the fronds of ferns on which were pustules of two species of *Milesina* new to Britain. The rusts of this genus seem to be exceedingly rare everywhere, yet on these leaves the pustules occurred in great abundance. It will be interesting to know if observers in other localities can now be as successful as Mr. Boyd in finding these minute parasites.

One of the species was *M. Kriegeriana*, which was abundant on *Lastrea spinulosa*, and less so on *L. dilatata* (= *aristata*), and *L. Filix-mas*. The other was *Milesina Polystichi* (Wineland) comb. nov., on *Polystichum angulare*. Miss Wineland records this species, which she found on *Polystichum munitum*, under the obsolete genus *Milesia* (*Milesia Polystichii* (*sic*), n. sp., in The Uredinales of Oregon, *Brooklyn Botanic Garden Memoirs*, 1918, i. 214). These fungi are hypophyllous, and occur chiefly on fading fronds; if such a frond is found in which some of the pinnules are brownish and beginning to wither, while the rest is still green, one may find, on looking at the underside of the affected parts, a number of minute yellowish-brown hemispherical pustules, $\frac{1}{2}$–$\frac{1}{3}$ mm. in diameter, usually *not* on the part occupied by the sori of sporangia. Within these pustules, which are enclosed in a very thin pale-brownish peridium, opening tardily by a central pore, there may be found a number of colourless uredospores, ovate or oblong, filled with granular or oily protoplasm, and adorned by a number of minute sparsely scattered acute spines. The teleutospores of *Milesina* have never yet been found in Britain (and rarely elsewhere); they are hyaline and septate, and should be looked for as lying *within* the cells of the dead or dying fern-leaf.

This opportunity may be utilised to enumerate what is now known of the British Fern-Rusts:—

Hyalopsora Aspidiotus Magn., on *Polypodium Dryopteris*. Very uncommon.

H. Polypodii Magn., on *Cystopteris fragilis*.—Scotland, N. Devon, Derbyshire, Wales.

Milesina Dieteliana Magn., on *Polypodium vulgare*.—Scotland (Perthshire, Ayrshire, etc.), N. Devon, Wales.

M. Blechni Syd., on *Blechnum Spicant*.—Ayrshire, N. Devon.

M. Scolopendrii Syd., on *Scolopendrium vulgare*.—Scotland, N. Lancashire, Shropshire, N. Devon, etc.

M. Kriegeriana Magn., on *Lastrea spinulosa, L. dilatata, L. Filix-mas*.—Ayrshire.

M. Polystichi Grove, on *Polystichum angulare*.—Ayrshire.

To these may possibly be added a *Hyalopsora* on (? cultivated) *Adiantum Capillus-Veneris*, but *Milesia Polygoni* Berk. and White (Ann. Nat. Hist. 1878, 5, i. 27), which seems to have puzzled some Continental mycologists, is merely a mistake, and was really intended for *M. Polypodii*: see *Grevillea*, xvii. 61, for explanation. It is, of course, not impossible that some of the forms named above are not really distinct, although small differences are to be observed between them.

A NEW VARIETY OF STACHYS SYLVATICA L.

By E. M. Cutting, M.A., F.L.S.

In 1919 a few clumps of plants were found, in the village of Shoreham, in Kent, that differed from the ordinary *Stachys sylvatica* in a few points only. There were specimens of the ordinary type in their vicinity, but no other species of *Stachys*; nor did the variants incline, in any of their characters, towards the allied species. This makes it very unlikely that the new form should be a hybrid, and indeed it does not agree with the descriptions that have been given for any of the *Stachys* hybrids. In 1920 the same spot was visited and fewer of these plants were found, the evidence, as far as it went, seeming to point to crossing between the new variety and the ordinary specific form, with consequent swamping of the new plant. I have succeeded in growing some of these and also some of the supposed hybrids, and hope to be able sometime to give a further description of them. Meanwhile, I have thought it worth while to record the occurrence of the plant and to describe shortly the few points in which it differs from the type-species. The most striking feature is the absence or almost complete loss of the purplish streaks that are so characteristic of the lower lip of the corolla of *Stachys sylvatica*. It has been pointed out to me by Dr. Salisbury, who kindly examined fresh and pressed specimens, that there were traces of two of the longitudinal marks. Since hearing from him, I have had the opportunity of examining fresh flowers and find that these are continuous with the coloured margin of the lower lip, and show but faintly. The corolla is of a brighter shade than that of the darkest flowers of the typical plant, but the intensity of colour differs much in the latter. At first sight the colour also seems to be of a richer tone, but this is probably due to a contrast with the large whitish spot on the lower lip. This area has a pruinose appearance owing to the presence of a number of peculiar hairs covered with knobs; these and the coloured undertissue modify considerably what would otherwise be an entirely white surface. The whole plant is light in colour, and the longitudinal purple stripes in the neighbourhood of the four ribs of the stem are not so strongly developed as in the type. This character also shows clearly in the reputed hybrids, whose flowers are lighter in colour than those of either parent, but have the usual markings on the lower lip.

If the specimens prove as fertile as the parent species, it should be a good plant on which to test experimentally the practical efficiency of lines as honey-guides. The inheritance of the mottling might also be a matter of interest. The preliminary technical difficulty of removing the anthers before self-pollination had been effected could probably be quite easily overcome.

I have been able to trace only one variety of *S. sylvatica*. This is described in Rouy's *Flore de France* as: "*β subsericeus* Grogn. Cat. Saône-et-loire; p. 189. Plante plus velue, subsoyeuse; feuilles plus petites, presque rugueuses." It is obvious that this is not the plant I have described above. In Townsend's *Flora of Hampshire* a var. *viridiflora* MSS. is mentioned, and is regarded as an undoubted abnormality: it is stated that Dr. Trimen found the plant at Stokes Bay, Gosport, in 1872. This seems to be a teratological and virescent form that has been found and described many times, as can be seen by referring to Penzig's *Pflanzen-teratologie*. Christ (in *Flora* 1867) gives a very good description of this form, and clear and characteristic figures. I have found similar virescent forms in the autumns of 1919 and 1920 at Downley, near High Wycombe, in Buckinghamshire, and Mr. Britten informs me that he found similar plants near my locality about 1867. These did not set seed, as even the ovules were affected; and probably were only reproduced vegetatively. There is no question of this plant being the same as the one I have here recorded; the latter showed no signs of virescence, no abnormality and seeded freely. Mr. Britten has kindly drawn my attention to a continental specimen in the British Museum, with a long MS. description by Gay. I have examined this specimen and the description, and I do not think that there is any similarity.

I append a short diagnosis:—var. IMMACUTATA: labro inferiore corollæ immacutato, subpruinoso; albo, subrubente. Tota planta minus solito viridis, nec adeo in caulibus purpurata.

SHORT NOTES.

POLLINATION IN ESCALLONIA MACRANTHA. In my garden near Cork there is a fine specimen of *Escallonia macrantha*: during the past summer it flowered freely, producing cymes with a copious supply of blossoms. I noticed that numerous humble and honey bees visited the flowers in succession; I watched their actions carefully and noted that the insects alighted on the corolla, the first pair of legs grasping the margins of the upper petals, the body resting opposite the anthers and stigma: when the legs were moved the pollen was disturbed and appeared to adhere chiefly to the two hinder pairs of legs and abdominal hairs. The insect moved towards the calyx and inserted its tongue between the corolla lobes, usually those on the surface facing upward. The petals in freshly opened flowers I found to be rather firmly adherent in the outer two-thirds, but in the inner third (*i.e.* near the point of insertion on the thalamus) they separate rather easily; soon after maturity there is a tendency to separation on the least pressure. In the young state, if separation cannot be effected, the humble-bee bores through the segments to reach the nectaries, which are situated in the ovary, the secreted nectar streaming down between the honey disc and the stamens, where it collects in droplets. It was quite usual to find portions of considerable size bitten out of the petal limbs to give free access to the nectar. The body of the honey-bee is shorter, less bulky and less hairy than that of the humble-bee, consequently the former did not appear to be as effective in distributing the pollen; but the legs and body of the honey-bee in my observation did touch the stigmas and anthers. The flowers are in axillary and terminal cymes and are proterandrous. Every facility was offered for effecting cross pollination. Other insects besides bees visited the flowers; a species of *Thrips* was a regular visitor and ran round the interior of the corolla-tube, often emerging through the holes bored by the larger insects opposite the nectary or where the petals had been pushed apart These insects may have been auxiliary in producing cross pollination, but are not, I think, as effective as bees. The plant produced numerous seeds, which escaped by decay of the soft tissues between the vascular bundles of the calyx-tube.

I can find no reference to pollination in *Escallonia* in the *Handbook of Flower Pollination* by Knuth or in Kerner's *Natural History of Plants*.—H. A. Cummins, University College, Cork.

H. W. Lett. An examination of Moyle Rogers's herbarium and MSS. gives evidence of the great debt which he owed to Lett (and Waddell too) for his knowledge of the *Rubi* of N.E. Ireland. *Rubus Lettii* is a name which records this fact; and botanists who are chiefly interested in phanerogams will easily recall other genera where Lett's researches and specimens produced important additions to our knowledge.—H. J. Riddelsdell.

REVIEWS.

The Bahama Flora. By Nathaniel Lord Britton, Ph.D., Sc.D., LL.D., Director-in-Chief of the New York Botanical Garden, Professor in Columbia University, and Charles Frederick Millspaugh, M.D., Curator of Botany, Field Museum of Natural History, New York; published by the Authors, June 26, 1920. G. K. Ackerman, Lorillard Mansion, Bronx Park, New York City. 8vo, cloth, pp. viii, 695. Price $6.25, post free.

In this volume we have one more evidence of the energy with which systematic botany is being pursued in the States, and of the care which is bestowed upon the floras of outlying regions. Two years ago, Dr. Britton published his *Flora of Bermuda* (noticed in this Journal for February 1919, p. 44), and now we have from him—

this time in conjunction with another New York botanist—a flora of the Bahamas, marked by the careful completeness which characterized the earlier work, and produced in equally admirable style. The two volumes naturally correspond in matters of detail: hence the nomenclature in both is that favoured by some American botanists in opposition to the more generally adopted Vienna Rules, and *Phragmites Phragmites, Moringa Moringa* and the like find place.

It is obvious that only those acquainted with the region to whose flora the book is devoted are competent to criticize the work from a botanical standpoint; all therefore that the present writer can do is to comment briefly on such of its contents as suggest themselves for remark while turning over the pages. There are several novelties: *Nidema*, an anagram of *Dinema*, is established for *Epidendrum Ottonis* Rchb. f., which thus constitutes a new genus; *Neothymopsis* for *Thymopsis* of Bentham, not of Jaubert and Spach, the type species being *Tetranthus thymoides* Griseb.; *Neobracea*, a monotypic genus, replaces *Bracea* of Britton not of King. Among the new species are three out of five in *Guettarda*, five out of eight in *Borreria*, and two out of three in *Oncidium*; other novelties are *Dolichos insularis, Polygala Wilsoni, Gerardia bracteosa, Lobelia lucayana, Encyclia inaguensis.* The coöperation of numerous botanists is acknowledged; Dr. J. H. Barnhart, who elaborated the *Lentibulariaceæ*, should be added to the list.

The principle "once a synonym always a synonym" leads to the supersession of *Coronopus* of Gaertner (1791) in favour of *Carara* Medic. (1792), as a consequence of the employment of the former name generically for *Plantago Coronopus* in the fourth edition of the Abridgement of Miller's *Gardener's Dictionary* (1754): should any British botanist be moved to adopt this principle, *Carara didyma* Britton will replace *Coronopus didyma* Gaertn. A new name—*Croton rosmarinoides* Millsp.—is substituted for *C. rosmarinifolius* Griseb., on account of the earlier existence of *C. rosmarinifolius* Salisb.: but this latter has no claim to recognition; it is a synonym given, in accordance with Salisbury's practice of substitution, to the already existing *C. linearis* Jacq., and is thus "stillborn." *Coccolobis* is substituted for *Coccoloba*, with a reference to Patrick Browne, who so wrote the name; but that author gives no generic description, and Fawcett and Rendle—we think rightly—ignore it on that ground. Under *Cassia bahamensis* Mill.," *C. bahamensis latifolia* Benth. Trans. Linn. Soc." is quoted as a synonym. This appears to us objectionable on three grounds. In the first place, Bentham assuredly did not anticipate the modern school which favours trinominal nomenclature; secondly, he indicated a doubt—"Var.? *latifolia.*" Our third criticism is more far-reaching: it relates to the omission of "in" before the citation of a periodical in which an author has published a paper—a method that occurs throughout this and other recent volumes of transatlantic origin and in which we see no advantage.

We note that, as in the *Flora of Bermuda*, each plant is provided with a name more or less in English; these are to be distinguished from real English or American names—the latter, many of them curious and interesting, have been supplied by Mr. L. J. K. Brace. Our protest against these manufactured synonyms in the Bermuda book (Journ. Bot. 1919. 45) led to an expostulation from Dr. Britton, whose experience with the public leads him to an opposite conclusion: their use, he thinks, removes the objection of most people to the use of Latin names for plants and animals, which they do not want to bother with: whereas they understand an English appellation. "I think," he adds, "that it is the duty of those of us who carry the actual scientific knowledge of the world to bring it as close to the people as we possibly can." In this we of course concur—we have no sympathy with those (if they exist) "who *Allium* call their onions and their leeks"—but we fail to see in what way *Ponthieva Brittoniæ* is brought closer to the people by calling it "Mrs. Britton's Ponthieva" nor—*pace* Dr. Britton—do we think that *Carteria* would ever in real life be called "Carter's Orchid." Something may be said for the coining of names for common plants which do not already possess them, as has been done for many garden species with some success; but when a plant becomes popular its accepted Latin name accompanies it: chrysanthemums, rhododendrons, geraniums, and the like needed no "English" equivalent as an introduction to the people, who are not likely under any circumstances to come in contact with plants of such limited distribution and insignificant appearance as those we have named. Nor do we see that *Metastelma Eggersii* benefits, from a popular standpoint, by being called "Eggers' [Eggers's] Metastelma"; or that anything is gained by calling the endemic *Neobracea bahamensis*, a name here first published, "Bahama Neobracea"; or why, merely because of its Latin equivalent, *Dendropemon bahamensis* should be specialised as "Bahama Mistletoe" when three other species (one endemic) occur in the islands. *Fissidens radicans* is hardly likely to become more familiar as "Radicant Fissidens"—one would have thought that the trivial might at least have been given in English!

FOUR NEW TEXT-BOOKS.

A Text-book of Plant Biology. By W. NEILSON JONES, M.A., F.L.S., Professor of Botany in the University of London, Bedford College, and M. C. RAYNER, D.Sc., late lecturer in charge, Department of Botany, University College, Reading. 8vo, pp. viii, 262, with 6 plates and 36 text-figs. Methuen: London, 1920. Price 7*s.* 6*d.*

College Botany, Structure, Physiology and Economics of Plants. By MELVILLE THURSTON COOK, Ph.D., Rutger's College, N.J. 8vo, pp. x, 392, tt. 226. Lippincott: Philadelphia and London. Price 12*s.* 6*d.*

The Selborne Botany for Schools. By PERCIVAL J. ASHTON. 8vo, pp. viii, 152, tt. 127. G. Gill: London. Price 2*s.* 3*d.*

Botany with Agricultural Applications. By JOHN H. MARTIN, Ph.D., Professor in Botany at the Iowa State College of Agriculture and Mechanic Arts. Second Edition Revised. 8vo, pp. xii, 604, with 490 text-figs. Wiley: New York, 1920. Price 21*s.*

The authors of the first of the four books which are the subject of this notice, remark in their preface that a good excuse would be required for adding yet another to the number of excellent general text-books on botany already on the market. An excuse might be found in some special method of treatment of the subject, or its presentation from a point of view more or less new. The new text-book not infrequently comes as a result of examination experiences, which have shown that many of the candidates have been inadequately prepared for the test. But the fault often lies with the teacher (or even the examiner) and not always with the text-book; as Dr. Cook implies in the preface to his *College Botany*, botany is the study of plants not of books. Prof. Neilson Jones and Dr. Rayner have aimed at designing an elementary course which will serve as an introduction to the scientific method; and also to enable the student or intelligent layman to acquire an understanding of the relation of plant-life to general biological knowledge. They have achieved a readable, well arranged and eminently useful introduction to the study of plants as living organisms.

The text falls into three parts: I. The plant as a machine, II. Reproduction, and III. The plant in relation to the outside world. The authors begin with the study of the properties of protoplasm and the cell-unit, and following chapters are devoted to respiration, water-relations, absorption of mineral salts, carbon-assimilation, assimilation of nitrogen, nutrition of heterotrophic plants and enzymes. A number of experiments are suggested and explained by text and simple line-illustrations. Part II. Reproduction includes two short chapters on methods of vegetative and sexual reproduction, a brief sketch of the outlines of classification, and a chapter on evolution, variation and heredity. Part III. contains three chapters:—Plant Response, dealing with "irritability" and the various kinds of plant-movements; Ecology and plant geography; and the Soil—a description of the various chemical, physical and biological soil factors.

The book is not profusely illustrated; the plates are reproduced from photographs; the text-figures are mainly simple diagrammatic line-drawings explanatory of the text; the aim has been to produce the book at as low a cost as possible, which, at any rate from the student's point of view, is to be commended.

In matter of form Dr. Cook's *College Botany* is in marked contrast to the *Text-book of Plant Biology*. It is well bound in stout boards, clearly printed with widely-spaced lines on faced paper, and profusely illustrated. Though half as large again as regards number of pages, it contains less matter than the more modest appearing English work. The American firm is to be congratulated on being able to produce an elementary text-book in so attractive a style. The volume is the outgrowth of the author's class-work, "an effort to present as many different phases of the subject as possible and to give the student a very general and very broad view," "and to meet the demand for applied botany by making a combination of the elementary principles of pure and applied science." The book is on familiar lines—Part I. on morphology, Part II. on physiology, and Part III. on outlines of classification. The treatment in detail suggests a student's notes of a lecture course, the illustrations representing the lecturer's diagrams. It will be helpful in so far as it serves to recall to the student the work he has done in the class-room or the field, or as suggesting what might be called a normal course of botany for a teacher. But the individual sections will need much expansion and explanation.

Mr. Percival Ashton's *Selborne Botany* falls into the same class as the preceding, though it is on a less ambitious scale and adapted for beginners. Mr. Ashton has accumulated a large number of photographs, many of them very good, illustrating the form and structure of flowering plants, and to some extent also their life-history and functions. These he has arranged in the form of an elementary text-book with accompanying letterpress. In the hands of a capable teacher it may serve as outlining a course for beginners on the lines which are ordinarily followed in schools; but it is hardly a book to put into the hands of an elementary student.

Apart from the alteration in the title, the second edition of Dr. Martin's text-book differs from the first in the addition of a chapter on variation and some changes in the presentation of the subjects of heredity and evolution. The subject-matter and arrangement generally remain practically the same, but many of the illustrations have been replaced by either new or improved ones, and several portions of the text have been rewritten. The title has been changed, as the former title, 'Botany of Agricultural Students,' might seem to imply a special kind of Botany, rather than the general principles of Botany so presented as to apply to practical affairs. The chief object in the botanical instruction of agricultural students is to teach the facts of botany, but these can be taught better if related to practical affairs, and hence the reason for choosing illustrations and presenting the subject matter so as to relate to practical problems. Whatever the aims of the student may be the fundamental principles of botany are the same. That the book has been well received is evident from the need for a new edition after about eighteen months; and the indication "total issue six thousand" which appears on the titlepage of the new edition suggests a continued demand.

The subject-matter is arranged in two parts, the first dealing with structure and function, the second with kinds, relationships, evolution, and heredity. A considerable proportion of the space is occupied by the illustrations, which are well-selected and very clear. In selecting examples and illustrations the author has chosen plants of economic use or interest; and matters of practical importance, such, for instance, as pruning, germination of seeds, and the like are treated more fully. The text is remarkably clear, and the volume will supply the American agricultural student with a useful insight into the botanical principles of his subject.

A. B. R.

Enumeratio Systematica Fungorum. By C. A. J. A. OUDEMANS. (2 vols. large 4to, pp. cxxvi+1230, xix+1069.) The Hague, 1919–20: Martinus Nijhoff. Price £6 6*s*.

WHEN Oudemans died in 1906 (at the age of 80) he left the manuscript of the present work, completed up to 1899; after that he occupied himself in annotating the work and preparing for the press, from which two handsome volumes have now been issued. The work is what is known as a "host index," and gives a list of the fungi occurring on European plants—"European" is interpreted in the very wide sense of any species occurring in Europe whether wild or cultivated; in like manner all fungi mentioned in literature as occurring on the host are listed, even though they have not been recorded for Europe. Many host indexes have appeared previously: most systematic books on microfungi indeed contain such indexes—extremely useful but liable to lead the unwary astray; none, however, have been anything like so full and complete as the present work.

A preface of nine pages by J. W. Moll gives the history of the compilation. The lavishness with which the work is produced is indicated by the fact that this preface is repeated in French, German and English, and is in itself full of redundancies. After Oudemans' death it was decided to carry on the work at which he had laboured for 25 years or more and to extend the references up to 1910. R. de Boer collected the material of the period 1899–1910, working from 1909 till his death in 1916; L. Vuyck and J. J. Paerels then took over the final arrangements of publication, the expenses of which were borne by the Hollandsche Maatschappij der Wetenschappen.

The families of host plants are arranged according to Engler's system, those of fungi by that of Saccardo. Genera and species are arranged alphabetically. Full bibliographical references are appended to the names of fungi, and only synonyms occurring in the quoted papers are given; hence a species occurring on different hosts has not always the same list of synonyms. The parts of the plant are gone through seriatim and a list of the fungi occurring on them is given in systematic order; there is thus considerable repetition. A list of authors, titles and exsiccata (2440) is added.

The fifth volume is to be an alphabetical list: if this be as complete as the body of the work, it will doubtless make the index extremely valuable. As it is, an ordinary working mycologist, unless he were at the end of his resources, would not trouble to use it as a "pons asinorum," as which the preface suggests it may be regarded. The typographical arrangement and printing leave nothing to be desired—our only complaint is that the work is too lavish and too large.

J. R.

BOOK-NOTES, NEWS, ETC.

THE *Times* of Feb. 22 contains a long notice of LOUIS COMPTON MIALL, F.R.S., who died at Far Headingley, Leeds, on the previous day. He was born at Bradford in 1842 and became interested in natural history at an early age; his work at first lay mainly in geology and palæontology, but subsequently extended to the study of insects, in connection with which he published valuable works. In 1862 he published, in conjunction with Benjamin Carrington, a *Flora of the West Riding*, for which he undertook the phanerogams and in which he had the assistance of J. C. Baker. "As a naturalist he was imbued with the spirit of Gilbert White, and was an enthusiast for what he called 'live natural history.' This spirit was most highly evinced in his two remarkable books *Round the Year* and *House, Garden, and Field*, as well as in a scholarly edition of the Natural History of Selborne; his book on *Object-Lessons from Nature* has done much to place nature-study on a sound scientific basis of close observation of nature." In 1871 Miall was appointed Curator to the Museum of the Leeds Philosophical Society; five years later he became the first Professor of Botany in the Yorkshire College of Science, and continued in that office in the University of Leeds until 1907. He then retired to Letchworth, where he published an excellent account of *The Early Naturalists and their Work*, which is noticed in this Journal for 1913 (p. 62).

At the meeting of the Linnean Society on Feb. 17, Dr. Rendle read a communication from Prof. G. B. De Toni, entitled "A Contribution to the Teratology of the Genus *Datura* L." Prof. De Toni described a hitherto unreported malformation of the flower of *Datura Stramonium*. A plant grown in the Botanical Garden at Modena produced flowers of two kinds; normal flowers appeared on the lower part of the plant and produced perfect capsules, but flowers produced in the upper part of the plant later in the year were remarkably different. In these the calyx was large and leaf-like, and inflated, recalling the ventricose calyx of *Physalis*; the corolla was absent, or represented only by small green structures; and the andrœcium and gynœcium were reduced to inconspicuous barren rudiments.

At the same meeting Mr. Ramsbottom gave some account of a collection of plants made by various members of H.M. Salonika Forces. Mr. A. J. Wilmott pointed out that the main interest of the collection, apart from the value of the material from this little-known region, lay in the features of endemism which the Macedonian flora exhibited. Endemics are said to be both numerous and abundant, which seems to be true so far as one can judge in a poorly explored area. A series of specimens of interest was exhibited, including several forms believed to be new to science. It was pointed out that *Silene juvenalis* is a common plant in Macedonia (=*S. subconica*), and that its occurrence on the reopened silver mines at Laurion, in Greece, is not surprising; Heldreich's suggestion that it had sprung up from seed which had been dormant 1500–2000 years may be dismissed. *Glaucium Serpieri* Heldr., of which the same was postulated, is not most nearly related to an Asia Minor or Persian form, but is either a variety of *G. flavum* as Halacsy places it, or a local or endemic form. Dr. Rendle considered the collection, which extends to about 4000 sheets, as the best of all service collections, and of great importance as allowing a fairly intensive study of a definite area.

On the same occasion Dr. G. C. Druce gave a short account of botanical work in the Shetlands, and showed a *Plantago* from the north of Balta Sound, which seemed so distinct from the surrounding *P. maritima*, *P. lanceolata*, and *P. Coronopus* as to be worth discrimination; it may be compared to *P. maritima* var. *minor* Hook., renamed by Boswell Syme as var. *hirsuta*. A short time in the Orkneys with Col. H. H. Johnston resulted in adding two plants to the Scottish flora—*Nitella nidifica* in the Loch of Stenness and *Chara canescens*. Mr. E. G. Baker considered that the specially noted *Plantago* did not materially differ from the variety *hirsuta* of of Syme.

At the meeting of the Linnean Society on March 3, Mr. R. T. Gunther spoke on certain manuscripts in the Library of Magdalen College, Oxford. The manuscripts exhibited were all bequeathed to the College by John Goodyer with his botanical library in 1664. Goodyer had not been a member of the College himself, but knew it through his father having been a tenant of a College farm at Alton (where he was born) through his brother-in-law, William Yalden of Sheet, who acted as one of the College bailiffs and clerk of the account, and through his heir and nephew, Edmund Yalden, who became a Demy and Fellow of the College. The manuscripts bound in Goodyer's time include his own translations of Theophrastus and Dioscorides into English: of the former Sir Arthur Hort published in 1917 a translation, noticed in this Journal for that year (p. 229); the latter has not been undertaken by any other scholar either before or since. One volume contains a long list of Grasses with their synonyms and short descriptions, descriptions of various plants copied from Lobel's MSS. (now lost?), and an Index of Plants in Goodyer's hand, an Index to Gerard's Herbal (1597) and Stonehouse's Catalogue of plants growing in his garden at Darfield in 1640 (see Journ. Bot. 1920, 170). The loose papers recently sorted and now bound comprise a part of the MS. material for Lobel's projected work, *Stirpium Illustrationes*, now bound in three parts—the first, containing the descriptions of 223 species of Grasses, has been bound in a cover which appears to have originally held notes *De Febribus* by Lobel's master, Rondelet: a volume of the leaves from which How's selection from Lobel's *Stirpium Illustrationes* was printed in 1655—this is a relic of the highest interest, typographical as well as botanical, and because it contains Lobel's original imprimatur signed by the President of the College of Physicians and other members: an original letter from Argent to Lobel, and How's animadversions on Parkinson. Two other volumes contain a Synonymy of Plants used by Goodyer, and the remains of a small Hortus Hyemalis in which ferns and mosses were preserved. Goodyer's miscellaneous papers bear out the high reputation in which he was held by his contemporaries—Johnson, Merret, Parkinson, etc.: they include dated descriptions of some 90 new or rare species of plants either collected by him or flowered in his gardens; early lists of plants grown in the gardens of William Coys in Essex in 1616, which is, therefore, the second English garden-list known; of Franqueville, Gibbs, Parkinson; and probably in his own garden at Droxford, Hants, where he lived until he moved to Petersfield on his marriage. Among other interesting details, Mr. Gunther mentioned that Mr. "Coel," Lobel's son-in-law, was identical with James Cole, a London merchant several times referred to with commendation by Gerard. Dr. Jackson pointed out that Lobel had another son-in-law, referred to as Ludovicus Myreus, apparently a London apothecary of repute, and named also by Clusius in his 'Exotica.' Thus Lobel must either have had two married daughters or a daughter who was twice married.

The *Kew Bulletin* (1920, 1: March) is mainly occupied by a revision of the Australian species of *Stipa*, by Miss D. K. Hughes, undertaken under Dr. Stapf's supervision. The number of species is raised from the 15 of the *Flora Australiensis* to 40, of which 17 are new: the paper is abundantly illustrated, and must prove a valuable contribution to the knowledge of the genus.

The "Report by the Director-in-Chief upon a Visit to Botanical Institutions in England," published by Dr. Britton in the *Journal of the New York Botanic Garden* for November last, is a sketch of "ourselves as others see us," which will be of greater value a hundred years hence than it is at the present time, although even at present it is by no means lacking in interest.

The *Proceedings of the Liverpool Botanical Society* for 1916–18, issued in February, indicate great local activity on the part of the members, both in field work and in meetings, and reflect great credit on those who are responsible for the organization of the Society. The reports of both outdoor and indoor gatherings are interesting, and a model of what such things should be; we would congratulate the Secretary of the Society, did we know who at present occupies the post, but his name is modestly concealed. A portrait of Mr. W. G. Travis, President of the Society during 1916–18, faces the title-page.

Dr. A. F. R. Wollaston has been appointed Medical Officer and Collector to the Mt. Everest Expedition which is to leave England shortly. Dr. Wollaston has done excellent botanical work in East Africa and New Guinea, and we look for further results from the Himalayan journey.

The *New Phytologist* for November and December (issued Jan. 31) contains the conclusion of Dr. Gates's paper on "Mutations of Evolution"; "Notes on Freshwater Algæ" from the Birmingham district (*Pyramimonas inconstans*, sp. n.) by W. J. Hodgetts; "Plant Families: a Plea for an International Sequence" by A. Gundersen; "The Evolution of Primitive Plants" by C. Schuchert. The subscription price of the journal is raised to 25*s.* net for the annual volume of 240 pages: single numbers will cost 7*s.* 6*d.* each.

The following is issued with the *Botanical Magazine* for Oct.–Dec.:—"In consequence of the increased and still increasing cost of producing Curtis's *Botanical Magazine*, the publishers propose to terminate the fourth series with the present issue, Vol. 16 (1920), or Vol. 146 of the complete work. Before committing themselves further they desire to ascertain in some way whether the work fulfils a sufficiently useful botanical and horticultural purpose to justify its continuance, and if so under what conditions it may be possible to do so."

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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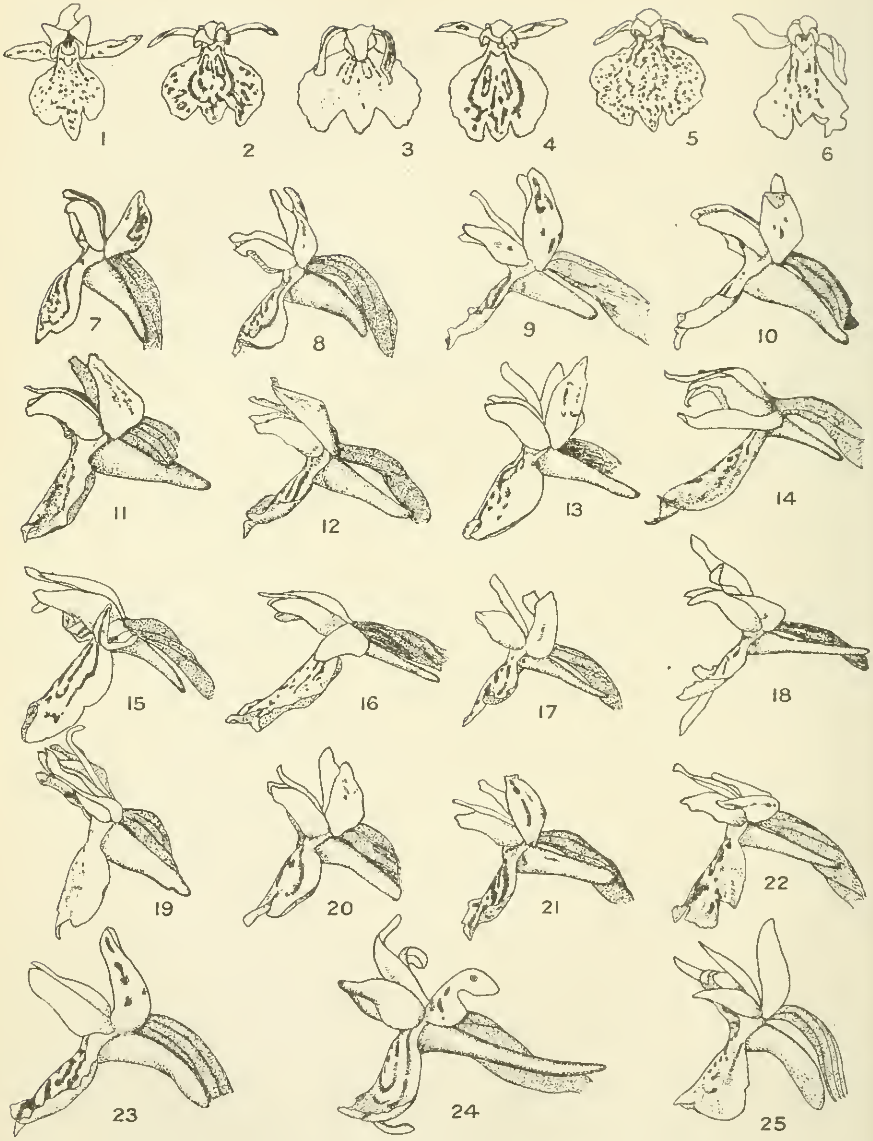
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Nos. 1—6, Lip-types of *ORCHIS ERICETORUM.*

Nos. 7–25, Side views of flowers of Marsh and Spotted Orchids.

THE FORMS OF ORCHIS MACULATA

(*O. maculata* L. including *O. Fuchsii* Druce (*O. O'Kellyi* Druce), *O. maculata* subsp. *ericetorum* Linton, *O. maculata præcox* Webster.)

By Rev. T. Stephenson, D.D., and T. A. Stephenson, M.Sc.

(Plate 559.)

We propose first to describe briefly the chief British types of the Spotted Orchis, and then to discuss the nomenclature, especially in relation to the continental forms. The main British types we shall refer to provisionally as *O. Fuchsii* (including the race *O. O'Kellyi*) and *O. ericetorum*. We regard these forms as quite distinct and deserving the rank of species.

Orchis Fuchsii Druce.

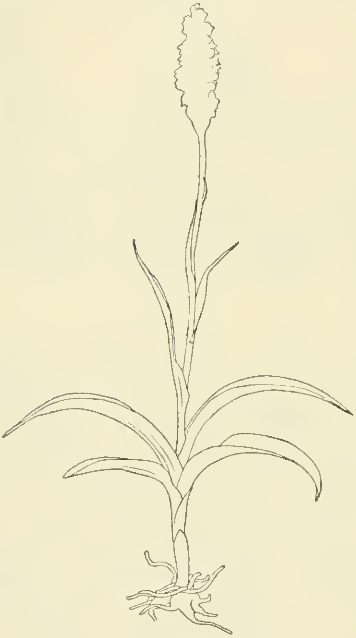
In some characters *O. Fuchsii* is intermediate between *O. latifolia* and *O. ericetorum*. It usually has sepals more erect and spur stouter than *O. ericetorum*, and broader and flatter leaves. Typically, however, it is a more slender and graceful plant than *O. latifolia*, with a more pyramidal spike; and in habit and lip-type is quite distinct from both of the other species. Difficulties in identification may arise, owing to the fact that any sort of hybrid crossing may occur, and under conditions of soil and moisture not favourable to the particular form.

The most characteristic type of *O. Fuchsii* is found in and about the margins of woods; it is a tall and often slender plant, 4–5 dm. high, with solid stem and spike 3–6 cm. at first markedly conical, the lowest bract generally exceeding the flowers. The upper leaves are bract-like and fall well below the base of the spike. The lower leaves are increasingly broad, and blunter and flatter than in *O. ericetorum*, the lowest of all being an almost perfect oval and shorter than those above. The difference is well brought out in figure B, which is taken from a photograph, the flatness of the leaves being well seen in the profile of one of the leaves on the right. The leaves are usually more or less thickly covered with spots and heavy blotches, though in a fair proportion of plants they are unspotted. The flowers are usually of a pale lilac or rose, but vary a good deal in intensity of tint. The spur is nearly straight, and regularly enlarged to the mouth, usually a little stouter than that of *O ericetorum* which is generally nearly filiform throughout, varies much in length, and, when long, is curved, and may be either longer or shorter than that of *O. Fuchsii* nearly always is. The lip is broader than long, about 6–11 mm. wide by 5–7 mm. long, or in some cases larger. The shape varies a good deal, but the centre-lobe is always marked off from the side-lobes by deep clefts, and its area relatively to that of the side-lobes is much greater than in the case of *O. ericetorum*, whose centre-lobe is very small. The side-lobes are often quite divergent from the centre-lobe, with high shoulders evenly rounded, sometimes angular or cuneate, entire or crenulate. The lip-pattern is oftenest in bright lines with a few spots within the lines; but some are spotted and marked all over, and some are very pale with no marks at all. Under similar conditions it flowers a little later than *O. ericetorum*.

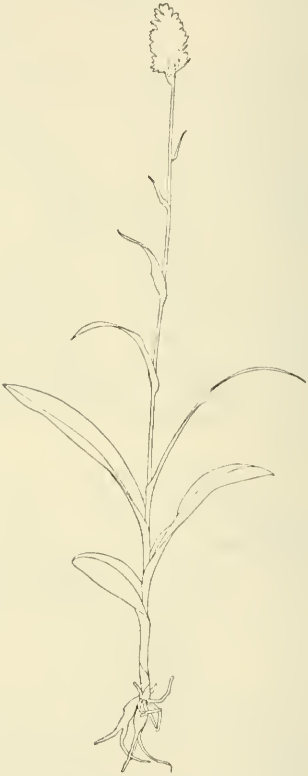
Examples of the lip of *O. Fuchsii* are given in t. 556. figs. 21 & 22, and the side-view in t. 559. figs. 17 & 18.

ORCHIS O'KELLYI Druce.

This beautiful plant was distinguished years ago by Mr. O'Kelly, and was named but not described by him as *O. immaculata*. It is slighter than the preceding type, about 2–3·5 dm. high. The leaves are unspotted, the lowest not so broadly oval, the flowers pure white, unmarked and rather small. The plant grows in the open in calcareous areas, plentifully in Clare and Galway, Ireland, also in Britain, sparsely. It appears to be a good example of a pure recessive (non-colour and non-spot) to the common form, with which also it sometimes crosses. We regard it as a race of *O. Fuchsii*, and not as a distinct species. Druce's description of *O. Fuchsii* is given in Bot. Exch. Club Rep. 1914, 105, and of *O. O'Kellyi* in Irish Nat. 1909, 211.



A. *Orchis ericetorum.*
Open meadow, Aberystwyth.
Height 32 cm.
Typical leaf-scheme.



B. *Orchis Fuchsii.*
Woodland, Aberystwyth.
Height 38 cm.
Typical leaf-scheme.

ORCHIS MACULATA L. subsp. *ericetorum* Linton.

O. ericetorum varies so much within its own limits, that a brief description of it is difficult. The most common type has a somewhat slender habit, solid stem, and narrow, recurved leaves, arching away from the stem, mostly spotted or blotched, but often without spots. The flower spikes are showy, the bracts inconspicuous. The flowers are of all shades of pale lilac to dark purple, with every possible variety of marking, in the form usually of fine spots and fine lines. The shape of the lip varies endlessly, the only general rule being that the area of the centre-lobe is very small indeed: it may be a mere rudiment. The shape of the whole lip varies greatly; it may be long or broad-oval, or cuneate or obcordate, with side-lobes scarcely or very much crenulate, in some cases almost frilled. The sepals are spreading or drooping, not at all erect unless quite exceptionally; erect sepals and thicker spurs may be notes of hybrid origin. The spur is more slender than in any other form, filiform in shape, regular right up to the mouth, sometimes very short, sometimes as long as the ovary and in that case curved.

An example of the commonest leaf-type is given in figure A: the chief points of difference between it and *O. Fuchsii* will be seen at a glance. Examples of the form and colour of the lip are given in t. 556. figs. 17–19, and of the side-view in t. 559. figs. 14, 15, & 16: in the latter plate varieties of the form and pattern of the lip are shown in figs. 1–6.

The plants vary greatly in size and stoutness, from 1 dm. in height to 1 m. The leaves may vary from 2 mm. to over 3 cm. in breadth; the upper are pointed and bract-like, the lower increase in length and breadth, the lowest but one or two being longest and often broadest; or they may be linear, and nearly all of the same width; in very large specimens they may be flat, or not much keeled, and reach 18–20 cm. in length. They may be linear, lanceolate, or ovate-lanceolate, blunt at the tip or rather acute, often strongly keeled, with or without recurved sides, the whole leaf often curving away from the stem in an irregular arc; unspotted or with many or few spots, small or large, or very rarely ringed. The bracts are usually slender, though they vary very much with the size of the spike; on very large spikes they may be quite as broad and long as in the Marsh Orchids. The spikes vary in size from 1·5 to 10 cm. or more. The colour may be pure white, or very pale lilac, and all shades up to bright purple, though generally the paler shades much predominate: the spur 4 to 10 mm. The lip-markings are in narrow lines and dots, in all sorts of combinations; there may be no lines, but a varying number of dots only. In one specimen gathered the whole of the centre of the lip was taken up by a patch of bright magenta. The size of the flowers varies greatly, as may be judged from the following lip-measurements, in which the first number given is the width:—16 × 10 mm., 15 × 10 mm., 13 × 8 mm., 12 × 9 mm., 11 × 11 mm., 9 × 11 mm., 9 × 5 mm., 6 × 7 mm., 6 × 5 mm., 5 × 8 mm., 5 × 5 mm., and 4 × 5 mm.: these are of fairly plentiful types. One plant we have has almost linear lips, 2 × 7 mm., another a small lip in which the side-lobes are almost rudimentary; in another the side-lobes of the lowest flowers were very large, but rapidly decreased in size until the upper lips were almost entire and very narrow, the extreme measures being 10 × 6 mm. and 3 × 6 mm.

The question of groups or subspecies of *O. ericetorum* may now be considered—in the first place the status of *O. maculata præcox* Webster (*British Orchids*, p. 54 (1886), p. 69, edn. 2, 1898) described this as a very small form of *O. maculata* which he found in Carnarvonshire, emphasizing its small size (4–7 inches), the early date of its flowering (April and May as against July for the other form), its love for very damp, elevated situations, and lastly the narrower leaves and small centre-lobe which distinguish *O. ericetorum* from *O. Fuchsii.* We have been over a good deal of ground in N. Wales, but have never found any plant which exactly answers to this description. The average of all highland forms is certainly above six inches, and in upland situations the time of flowering, in our experience, is rather May–July, or even August. The habitat also is imperfectly described; such forms do often grow in very wet places, but that is not the rule. They seem to prefer the zone between the wet and the dry levels; often, when traversing a piece of boggy ground, we have made for the drier margin to look for the plants, and found them there, almost as a matter of course. We are therefore quite confident that *O. præcox* is the same as the plant described some years later by Linton (Fl. Bournemouth, 1902) as *O. maculata* subsp. *ericetorum*; the difference is owing to the fact that Webster has given a far too restricted description, based on a batch of exceptionally small and early-flowering plants. Both authors agree in assuming that the strongly trilobed form is the true *O. maculata* of Linnæus—a point which will be discussed later.

It is necessary to emphasize the fact that *O. ericetorum* may grow to a very large size, and in this form may easily be mistaken for a Marsh Orchis. It is probable that field botanists are apt to pass by these large forms, without strict examination, as pale *O. latifolia* or as hybrids, the more so as they are usually found in marshes with the other forms. The determination of hybrids will be much affected by the failure to note a possible parent. Plants over 5 dm. high are common enough, usually with large and rather flat leaves, solid stems and typical *O. ericetorum* flowers, the spur slender, sepals lax and centre-lobe very small.

Dr. Druce suggests, as indirectly did Camus in the reference given further on, that the differences in this group of plants may be due to differences of soil. Druce would assign *O. ericetorum* to acid siliceous areas: it is absent from large parts of the central and eastern counties. *O. O'Kellyi* grows on calcareous well-drained soil, and *O. Fuchsii* especially on chalk and basic clay. These forms may be most at home in these different soils, but they are not rigidly confined to them. *O. ericetorum* and *O. Fuchsii* often grow together in lowland positions; in a field at Kerry, Montgomery, in a rich loamy clay with no peat, both types occur in plenty. Here the leaves of *O. ericetorum*, being in long grass, are flatter than if they grew in a pasture, but are not of the *Fuchsii* type. Moreover, though this is exceptional, we have seen flourishing colonies of both types growing in pure bog, in sphagnum,—in these cases separately, the other type being nowhere in the neighbourhood. Such examples do not much favour the soil theory, and support the view that we have here distinct species. At Aberystwyth, fine typical plants of *O. Fuchsii* grow in the margin of a wood, but many stray into an adjoining pasture, where hundreds of plants of *O. ericetorum* are found. Here they become short, some very short, but otherwise retain all their characteristic features. On the other hand *O. ericetorum*, when it strays into the wood, retains its own characters. One specimen which we transplanted from the field to the wood came up next year with its leaves flatter than they had been and longer and narrower, but without flowering. Next year it came up with exactly similar leaves, and flowered; the flowers were precisely what they had been in the open field.

There are many forms intermediate between *O. Fuchsii* and *O. ericetorum*. Some of these are probably hybrids, named by Druce *O. transiens* (Bot. Exch. Club Rep., 1915, 213). He notes two types, one of which has the leaf-scheme of *O. Fuchsii* with the flowers of *O. ericetorum*, the other with the characters reversed. Where both forms grow together we have noted a few such intermediates. In the field just referred to, at Aberystwyth, after the ordinary *O. ericetorum* was over but *O. Fuchsii* in the wood was in full flower, we found two fine plants in the field with the leaf-type of *O. Fuchsii* and the flowers of *O. ericetorum*. These were almost certainly hybrids.

Apart from possible crosses, a certain number of plants will be found in any large gathering of *O. ericetorum* in which the centre-lobe is fairly large. Often this is receding, so that, though large, it does not equal in length the side-lobes. In most cases also, even if it exceeds the side-lobes, it does not comprise a large proportionate area of the lip, as in the case of true *O. Fuchsii*; the almost filiform spur will also indicate the *ericetorum* type. See t. 556, no. 17.

In this paper it is impossible to touch upon the many hybrids of the Spotted Orchids with the Marsh Orchids and with other forms; it can only be noted that they are numerous and exceedingly interesting. A flower of *O. ericetorum* × *Gymnadenia conopsea* is given in Pl. 559, fig. 24. Note the long spur and the stiff curled sepals.

We must now touch on the relations of the two main British forms to *O. maculata* of Linnæus, as well as to continental forms and their naming.

Dr. Druce (Bot. Exch. Club. Rep., 1914, 99) argues that *O. maculata* L. had up to that time included two distinct species, of which the form with the small centre-lobe, the *ericetorum* form, ought to be reckoned as the true *O. maculata*. There is some ground for this contention. Linnæus (Sp. Pl. 942) characterises the mid-lobe of the lip as "*angustissimo, integerrimo*," which suits the *ericetorum* type but not the *Fuchsii* type. Moreover, the specimen in Linnæus's herbarium, if found in any collection of British plants, would undoubtedly be assigned to the *ericetorum* type. It has keeled, reflexed leaves, and a very small centre-lobe, not produced, or scarcely so, beyond the side-lobes; the plant, of which the lowest leaf is missing, is slender, about 30 cm. high. Here specimen and description are in full agreement. From this point of view, Webster and Linton were in error in assuming that the *Fuchsii* type was true *maculata*, and if their names stand at all, it can only be as varieties of the small-lobed type; they have really redescribed the original form. Accordingly we should expect to find that *O. ericetorum* is common in Northern Europe; but Col. Godfery in writing and conversation has frequently insisted that this is not found on the Continent at all, and that the continental form that comes nearest to it is the subsp. *elodes*. As to this we have ourselves no means of judging: the description of *elodes* in Camus does not help much. It states that the plant is slender, with leaves unspotted or only faintly spotted, flowers pure white or tinged with very pale rose, usually unspotted or with few spots, and, as the name suggests, a marsh plant. The lip may be near the *ericetorum* type, but very few British plants would fall within such a description.

Yet when we start from another side of the question, and consider the continental usage, it appears that the *Fuchsii* type has been generally accepted as true *maculata*; when however we come to exact descriptions we do not find it easy to locate the *British Fuchsii* form. The var. *trilobata* of Brebisson and var. *Meyeri* of Reichenbach, which Rouy regards as synonyms, refer to a plant which, though markedly trilobed, is described as slender, with slender spurs and small flowers—a description which would not cover by any means all of the British forms; nor does the figure in Reich. Icones, 516, suggest the British species at all closely. Klinge (Act. Hort. Petrop. xvii. 192; 1899) speaks of two forms of *O. maculata*: in one the lip is cuneate and broadest towards the tip, the mid-lobe longer and the spur smaller and slender, whilst in the other the side-lobes are more rounded and the centre-lobe small, not exceeding the side-lobes, and the spur stouter and longer. Here we have the larger and smaller centre-lobe, but the other points do not agree with British forms; in our trilobed forms the side-lobes are by no means always, or even usually, cuneate, and the spur is not more slender, but the other way. Camus (Journ. de Bot. 1894, 49) distinguishes three races of *O. maculata* var. α, *trilobata*, with slender spike, at first conical, flowers small, lip with three deep lobes, the centre-lobe much exceeding the side-lobes, the lower leaves oval-suborbicular. It is the form of dry hill-sides. This must be practically the same as Druce's *Fuchsii*, only that with us it may grow in very damp ground. In var. β the spike is more cylindrical, flowers rather large, lip with three not deep lobes, lower leaves acuminate. It is found in meadows. In var. γ, *palustris*, the spike as in var. β, the flowers are rather large, usually bright rose, with acuminate mid-lobes, and large undulate-crenulate side-lobes, the lower leaves acuminate. It grows in peaty marshes. Here it looks as if var. β might correspond to our *ericetorum*.

Other descriptions as cited by Druce are rather vague, and supply at least a fair justification for giving a new name to our very distinct British form. Yet, however baffling some of the descriptions may be, we have seen plates (*e.g.* that of *O. maculata* in Correvon's *Album* *des Orchidées*) photographs and specimens of plants which are precisely like our robust forms of *Fuchsii*. We would suggest that the two main types have not been quite accurately distinguished, and the fact has been overlooked that the form regarded as typical on the Continent does not really agree with Linnæus's description. Thus, paradoxically, according to continental and British usage, Druce's *Fuchsii* would have to be taken as true *maculata*, and *ericetorum* as a new species or sub-species, although it *does* agree with Linnæus.

It would very much clear up the situation if continental botanists would consider the leaf and lip types as given in our plates and figures, and say how far they can be definitely identified with the continental forms. Especially they might consider the practical certainty that two distinct species are to be distinguished, and in that case the claims of Druce's *Fuchsii* to be separated as the new species, leaving the forms with small centre-lobe as true *maculata*. If this is not approved, *O. Fuchsii* must be taken as true *maculata*, and *O. ericetorum* as a subspecies, or (preferably) as a new species. The question appears to be whether we are to be governed in our final decision by long-established (and somewhat blind) usage, or by the strict interpretation of the written definitions of the forms. On our side, we are not in a position to decide until we know more about the continental forms; and furthermore we are not ourselves so much interested in the nomenclature, our point being to establish the two forms (provisionally referred to as *ericetorum* and *Fuchsii*) as species, and to comment on them. In our papers, therefore, we have used these names for the sake of perfect clearness, without wishing to attempt a final decision on the nomenclature.

Note.—The accompanying plate (559) in the main is intended to supplement the coloured plate published in Nov. 1920. Figs. 1–6 give specimens of the endless varieties of the *ericetorum* type. All the rest give side-views of lips corresponding to the front views of t. 556. Here a fairly even gradation will be noticed from the stoutest forms of *incarnata* and *purpurella*, then *prætermissa* and *latifolia*, to the slender forms of *maculata*. It may be noted that though in the plants figured the spurs of *Fuchsii* are not stouter than those of *ericetorum*, we believe that in general they are distinctly stouter. Fig. 24 gives the side-view of a flower of the hybrid of *O. ericetorum* with *Gymnadenia conopsea*, of which no figure is given in t. 556. Hybrids of the last-named species with the *Fuchsii* type also occur; they vary a good deal, but always have long, slender spurs and a very delicate scent and colour. The figures in Pl. 559 are some of them drawn from the same individual flowers as those in Pl. 556, sometimes not.

Explanation of Plate 559 (Supplementing Plate 556).

Nos. 1–6. *O. ericetorum*. Front view of lips, to show varieties of form and pattern.

Nos. 7–25. Side-view of separate flowers.

7. *O. incarnata*. Shrewsbury. Same plant but not same flower as Pl. 556, 24.

8. *O. incarnata.* Borth. Same plant but not same flower as Pl. 556, 2.
9. *O. purpurella* form (*a*). Aberystwyth. Same plant as ,, 9.
10. *O. purpurella* form (*b*). Same plant as ,, 10.
11. *O. prætermissa.* Kidwelly. Same plant as ,, 6.
12. *O. latifolia* form B. Borth. Same plant as ,, 14.
13. *O. latifolia* form C. Kidwelly. Same plant as ,, 15.
14. *O. ericetorum.* Tregaron. Some type as ,, 19.
15. *O. ericetorum.* Aberystwyth. Same flower as ,, 17.
16. *O. ericetorum.* Aberystwyth. Same plant as ,, 18.
17. *O. Fuchsii*, field form. Same plant as ,, 21.
18. *O. Fuchsii*, woodland form. Aberystwyth. Same plant as ,, 22.
19. *O. prætermissa*, pale form. Kidwelly. Same plant as ,, 8.
20. *O. incarnata* × *O. latifolia.* Kidwelly. Same plant as ,, 23.
21. *O. purpurella* form (*a*) × *O. latifolia.* Aberystwyth. Same plant as Pl. 556, 11.
22. *O. purpurella* form (*a*) × *O. ericetorum.* Aberystwyth. Same flower as Pl. 556, 12.
23. *O. latifolia* form A. Aberystwyth. Same plant as Pl. 556, 13.
24. *O. ericetorum* × *Gymnadenia conopsea.* Devil's Bridge, Card. Not represented in the coloured Plate.
25. *O. incarnata* × *O. latifolia.* Shrewsbury. Same plant as Pl. 556, 20.

NEW EBENACEÆ FROM PORTUGUESE CONGO.

By W. P. Hiern, M.A., F.R.S.

The species hereunder described, as well as three or four other *Ebenaceæ* not new to science, form part of a large and important collection recently sent to the Natural History Museum by Mr. Johannes Gossweiler, a collector favourably known for his valuable work during several years in Angola. This time it is the Mayumbe district lying close to and north of the mouth of the Congo which has been the chief scene of his labours. Besides Buco Zau, the habitat of the three new species here described, specimens were obtained from several other places, among which Belize is worthy of special mention. The result has been to add a considerable number of novelties to the flora of this little known part of Africa.

Maba nutans Hiern, sp. n. *Frutex* sempervirens 8 m. altus; *caule* a basi diviso ramis nutantibus; *ramulis* teretibus levibus glabrescentibus internodiis c. 2 cm. longis fuscis; *foliis* alternis ovali-oblongis sæpe obtuse acuminatis basi obtusis glabris 15–20 × 6–8 cm. supra nitidis infra sub-pallidioribus tenuiter coriaceis margine integro anguste revoluto costâ supra anguste impressâ infra validâ expressâ nervis lateralibus patulis ascendentibus tenuibus reticulatione inconspicuâ, petiolo fusco c. 1 cm. longo; *floribus* albis fragrantibus c. 1 cm. longis sessilibus in cymis abbreviatis contractis plurifloris glabris dispositis; *calyce* breviter campanulato sub-glabro 1–3 mm. alto 3–3·5 mm. diam. breviter 3-lobo lobis rotundatis 3 mm. latis 1 mm. longis; *corollâ* tubulosâ glabrâ vel minute glandulosâ tubo cylindrico 9 mm. longo 3 mm. diam. limbo patente vel reflexo

5–6 mm. diam. 3–4-lobo lobis ovalibus contorto-imbricatis 4–5 × 3 mm. apice rotundatis; *staminibus* 9–12 glabris 3–4 mm. longis basi corollæ insertis antheris c. 2 mm. longis filamentis filiformibus; *ovario* nullo.

Mayumbe, Portuguese Congo, Buco Zau, in shady woods; *Gossweiler, sine numero.*

The species belongs to the section *Holochilus* of the genus, and is related to *M. Elliotii* Hiern.

Diospyros diopa Hiern, sp. n. D. fruticosa vel arborescens, glabra, ramulosa, nitida, fuscescens; *ramulis* gracilibus infirmis alternis sub-teretibus ascendentibus levibus foliosis; *foliis* ellipticis vel ovato-lanceolatis alternis integris nitidis chartaceo-coriaceis apice elongato-acuminatis basi oblique angustatis 4–8 × 1·5–4 cm. unicoloribus sub-sessilibus, costâ nervisque gracilibus reticulatione delicatâ pellucidâ; bracteâ axillari ovatâ conduplicatâ glabriuscalâ 3½–5 mm. longâ florem femineum amplectente; *floribus* femineis axillaribus solitariis sub-sessilibus vel brevissime pedunculatis; *calyce* scutelliformi 4-partito 5–6 mm. diam. segmentis subrotundatis imbricatis 2·5–3 mm. latis 2 mm. longis margine ciliatis; *corollâ* deciduâ (non visâ); *ovario* sub-globoso sub-apiculato nitido glabro 3 mm. diam. apice umbilicato bi-loculato loculis 2-ovulatis ovulis pendulis; *stylis* 1–2 brevibus.

Mayumbe, Portuguese Congo; *Gossweiler* 7634.

The prominently embracing bract and the 2-celled ovary are distinguishing characters of this species.

Diospyros viridicans Hiern, sp. n. *Arbor* elegans 25 m. alta vel ultra trunco gracili ascendente cortice fusco ligno fusco ramulis alternis glabratis striato-angularibus erecto-patentibus fuscis novellis puberulis; *foliis* alternis ovali-ellipticis apice abrupte breviter acuminatis basi obtusis vel inæqualiter sub-cuneatis tenuiter coriaceis integris 7–10 × 3·5–4·75 cm. supra glabris nitidis infra glabriusculis sub-pallidioribus marginibus angustissime revolutis costâ tenui puberulâ venis lateralibus alternis utrinque 5–6 tenuibus reticulatione delicatâ petiolo mediocri recto puberulo 3–4 mm. longo; *floribus* extus viridicantibus 4 mm. longis (in alabastro) tetrameris breviter pedicellatis in cymis axillaribus pedunculatis plurifloris puberulis 1–1·5 mm. diam. dispositis pedunculo communi axillari puberulo 3–4 mm. longo bracteolis brevibus puberulis; *calyce* breviter campanulato 4-fido plerumque glabro 1 mm. alto 1·5 mm. diam. lobis rotundatis minute ciliolatis 0·5 mm. longis 0·5–1 mm. latis; *corollâ* glabrâ 4-fidâ 3·5 mm. longâ extus flavido-albâ lobis suberectis non patulis ovali-oblongis obtusis c. 3 mm. longis 1·5 mm. latis; *staminibus* c. 20 glabris 2·5–3 mm. longis antheris inæqualibus linearibus filamentis brevibus gracilibus basi corollæ insertis; *ovario* rudimentario hispido.

Mayumbe, Portuguese Congo; Buco Zau, in moist situations; *Gossweiler* 6955.

Native name "Secuia." Wood much used for walking-sticks and cabinet work.

SPERGULARIA MARGINATA VAR. GLANDULOSA DRUCE.

By H. W. Pugsley, B.A., F.L.S.

In perusing the new volume (iii.) of the *Cambridge British Flora*, I notice (p. 23) that this plant is reduced to the status of a subvariety, with a description "Shoot more or less strongly glandular." In Dr. Moss's description of the species the shoot is stated to be "glandular or eglandular," and it may thus be assumed that if the shoot can be termed strongly glandular, the plant belongs to the subvariety *glandulosa*.

The inflorescence of *S. marginata*, as seen in many British saltmarsh localities, is more or less glandular, this feature being very variable in this as in some other species of the genus, but such plants are by no means necessarily identical with the form on which Dr. Druce's variety was founded, the characters of which Dr. Moss does not seem to have fully appreciated. The variety *glandulosa* was described in the *Report of the Botanical Exchange Club for 1899*, i. p. 599 (1901), from specimens collected on the chalk cliffs at Dover, where it had been previously reported as *Lepigonum marinum* in the *Phytologist* (N. S. v. 44: 1861). The description is not very complete, but the plant is said to have a woody rootstock, and the pedicels and calyces distinctly glandular.

It happens that in 1899 I collected this particular form on the neighbouring cliffs at Lydden Spout, whence Dr. Druce subsequently sent an example to the National Herbarium, and in 1906 I gathered it also at the base of Abbot's Cliff, Dover.

The plant has a woody rootstock and, compared with the typical saltmarsh form, is compact in habit and much branched. These features may be due to the situation in which it grows. The upper part of the stem is more or less glandular, and the pedicels and calyces very strongly so: a few glands also appear occasionally on the uppermost leaves. In addition to these points of distinction, the pedicels of the lower flowers, which Dr. Moss notes as markedly longer than the calyx in *S. marginata* or sometimes twice as long, are distinctly shorter than in the typical saltmarsh plant and often do not greatly exceed the calyx. Moreover, the petals of the Dover plant are quite deep pink in colour though becoming paler towards the base.

In view of all these differences, the retention of this plant as a full variety seems justified, and Dr. Druce's name must apparently stand, for although it is published under *Buda media*, the possibility of changes of both the generic and specific terms is duly anticipated!

The features of this plant recall the hybrid *S. marginata* × *salina*, as described and figured in the *Cambridge Flora*, but there is no reason to suspect its hybrid origin, and it produces uniformly and in abundance the round, broadly winged seeds characteristic of *S. marginata*.

I have collected this variety not only at Dover and Lydden Spout, but (with paler flowers) on cliffs at Winspit, Dorset, and on wet, stony ground on the shore at Llanfairfechan, Carnarvon. There are also examples in Herb. Mus. Brit. from the Plym Estuary (*Archer Briggs*, 1875), Chesil Beach (*Riddelsdell*, 1912), Lulworth (*Ridley & Fawcett*, 1883), Hunstanton (*T. B. Blow*) and Walney Island (*Hodgson*). The plant is probably widely distributed on sea-cliffs and wet rocky or stony shores.

There also exist in Herb. Mus. Brit. several Scottish examples (Burntisland, *Hunter*; Auchmithie, *Carnegie*; Nairn, *E. S. Marshall*, no. 2139; Kirkibost, N. Uist, *Shoolbred*) that possess the same relatively compact habit, short pedicels and bright pink petals as var. *glandulosa*, in combination with a much less glandular development. These seem to be a modification of this same variety, and not of the saltmarsh type, and may be distinguished as a form thus:—

SPERGULARIA MARGINATA Kittel, var. GLANDULOSA Druce, b. GLABRESCENS, forma nova.

Planta habitu compacto, pedicellis brevibus petalisque roseis ut in varietate *glandulosâ*, sed parce glandulosa vel etiam subglabra.

THE DRAUGHTSMAN OF THE 'HERBARUM VIVÆ EICONES.'

By Agnes Arber, D.Sc., F.L.S.

In a paper on "Brunfels and Fuchs" in this Journal for 1919 (lvii. 236) Dr. A. H. Church discusses the identity of the draughtsman responsible for the illustrations in the famous *Herbarum vivæ eicones* of Otto Brunfels, published by Schott, of Strasburg, in 1530, and concludes that "from internal evidence it may be sufficiently assumed that Brunfels drew the figures himself." In 1912 I had written (*Herbals*, p. 171) that "the illustrations in Brunfels' herbal were engraved, and probably drawn also, by Hans Weiditz, or Guiditius, some of whose work has been ascribed to Albrecht Dürer." Dr. Church criticizes this passage in the following terms:—"Arber naively suggests that the engraver drew them—so used are we to the inferiority of the artistic profession; but there is no reason why they should have been so done, any more than modern work is left to the printer or process-engraver."

In the light of Dr. Church's criticism, I have reconsidered the question, but a further study of the subject leads me to reaffirm my former belief that Weiditz not only engraved but also drew the splendid series of illustrations which give the *Herbarum vivæ eicones* its epoch-making character. Since Dr. Church relies mainly on internal evidence, we may first look at the subject from this point of view. These woodcuts have a marvellous sureness and decision of line, and show a virility of handling, which to me suggest the work of a man who is engraving his own design, rather than interpreting someone else's drawing, and, further, these pictures have in every way the look of the finest type of professional work; whereas, if Brunfels, as Dr. Church suggests, did them himself, they must have been merely amateur efforts. Brunfels, who was for many years headmaster of a grammar-school at Strasburg, eventually became town physician at Bern; he also produced copious theological writings, which must have consumed much time and energy. If these occupations left him the leisure to become an artist of the calibre of the draughtsman of the *Herbarum vivæ eicones*, he must have been indeed an Admirable Crichton!

But in this problem we are fortunately not obliged to rely only on internal evidence. When Dr. Church suggests that to identify the wood-engraver of the *Herbarum vivæ eicones* with the draughtsman is like confounding the process-engraver with the artist in the case of modern work, I think he is both forgetting the position which certain wood-engravers occupied in the sixteenth century, and ignoring what we know about Weiditz himself. Heinrich Röttinger's critical monograph—*Hans Weiditz der Petrarkameister*, published in 1904—has put us into possession of a mass of detail about his work. He was by no means an obscure craftsman, but a wellknown illustrator who was responsible for the figures in a long series of books. After discussing the woodcuts in the *Herbarum vivæ eicones*, Röttinger concludes that Weiditz must "be expressly honoured as the draughtsman of the plant-figures." He founds this opinion more particularly on a passage in the introduction to the German edition of Brunfels's herbal which was produced by Schott in 1532 under the title *Contrafayt Kreüterbuch*: in this passage the plants are described as "delineated and portrayed by the highly illustrious master Hans Weiditz of Strasburg." I think the verbs used—"gerissen, und contrafayt"—are open to no other interpretation than that Weiditz himself was the draughtsman as well as the engraver.

MISCELLANEA BRYOLOGICA.—VII.

By H. N. Dixon, M.A., F.L.S.

(Continued from Journ. Bot. 1919, p. 80.)

Hypnum replicatum Hampe.

In a paper on South Indian mosses in 1914 I described as a new species of *Sematophyllum* a Ceylonese plant of Father Queste's as *Sematophyllum pilotrichelloides* Card. & Dixon. I was not then aware of the existence of *Hypnum replicatum* Hampe, which has not been hitherto placed under *Sematophyllum*. Jaeger and Paris retain it under *Hypnum*. Brotherus (Musci, ii. p. 1119) suggests its identity with *Trichosteleum ramulinum* (Thw. & Mitt.).

In looking through some specimens of Hampe's at the British Museum recently I accidentally came across his *H. replicatum*, and found that it was identical with our *S. pilotrichelloides*. Hampe's type differs in one or two minor characters—the leaves are more widely spreading on the branches, and slightly more concave with margins more convolutely enrolled,—but the differences are too slight to constitute a specific distinction. It is a very striking plant, with a quite unusual habit for the genus.

Trichosteleum ramulinum is a very different plant, with the secondary stems cæspitose, not pendulous; the leaves much longer, undulate when dry, etc.

The synonymy will stand thus:—

> SEMATOPHYLLUM REPLICATUM (Hampe) Dixon comb. nov.
> *Hypnum replicatum* Hampe in Nuov. Giorn. bot. ital. iv. 279 (1872).
> *Sematophyllum pilotrichelloides* Card. & Dixon in Records Bot. Surv. India, vi. 88 (1914).

RIGODIUM DENTATUM Dixon.

I described this species in Bull. Torr. Bot. Club, 43: 79, from "Pretoria, Transvaal, 1914, communicated by the Rev. Hilderic Friend." I have since been informed by Mr. Friend that the above labelling was an error, and the locality should have been given as "Cape Town." It seems desirable that this correction should be made known.

EURHYNCHIUM MERIDIONALE in Britain.

Some slight doubt has been attached to the claim of this species to be a British plant, as no specimens of Mr. Binstead's plant from Wells are to be found in Braithwaite's collection, and it seemed possible that it might have been recorded in error. The figures in Braithwaite's Brit. Moss Flora are without doubt from the true plant, but there was the possibility of these having been drawn from a continental specimen, the more so that Braithwaite figures a fruiting specimen, while Mr. Binstead's plant was sterile. Mr. Binstead has, however, lately found a letter from Dr. Braithwaite stating that the drawings of the leaves, though not of the fertile stem, were made from the Wells plant. And the status of *E. meridionale* as a British plant has been finally set at rest by its discovery at Portland, Dorset. In 1917 Mr. E. Cleminshaw sent me for confirmation some mosses from the herbarium of the late Wm. West, then in his hands for examination; one of these proved to be undoubtedly *E. meridionale*. It was labelled "*Eurhynchium meridionale* De Not. . . Portland. W. C. P. Medlicott leg., Sep. 1881, teste H. Boswell (as *E. striatum* var. *meridionale*)."

This interesting moss was refound at Portland, by Messrs. Sherrin and Chipperfield, on Aug. 21, 1919; the specimen which I received from Mr. Sherrin agrees in all respects with the continental plant.

TORTULA INERMIS (Brid.) Mont. as a British Plant.

The evidence for this South European plant as a native of Britain rests entirely on a specimen "Near Cowie Moss, Stirlingshire, coll. Kidston and Col. Stirling, 3 June, 1895" in Braithwaite's herbarium. This is, however, without doubt due to an unfortunate error on the part of Dr. Braithwaite. The specimen sent to me belonged undoubtedly to *Tortula inermis*; but the locality seemed a most unlikely one. Meeting Dr. Kidston in 1910, I asked him about the habitat of the plant; he told me that it was on a tree frequently submerged by a stream. Now this is a quite impossible station for *T. inermis*, a plant of hot, dry banks in the Mediterranean region; but is precisely the habitat affected by *T. subulata* var. *subinermis* Wils., and when later on Dr. Kidston kindly sent me a specimen of the original gathering *, it proved to be, as I had anticipated, this marked subaquatic variety of *T. subulata*, and in no way resembled the *T. inermis* sent me by Dr. Braithwaite. Later, on the occasion of a visit to Dr. Braithwaite in 1911, I asked to see the specimen: he showed me his sheet of *T. inermis*, which contained one packet only, from the South of Europe; this appeared identical with the specimen he had sent to me, and I have no doubt that the latter was actually taken from this South European specimen. I asked him if he could show me the actual Scottish plant, and he said it must have been mislaid, and he should no doubt come upon it later.

There can be no doubt, I think, that Dr. Braithwaite had, by a confusion of names, taken the Stirlingshire plant for the S. European *T. inermis*, had mounted this South European plant for comparison—as was his custom, it being a good fruiting specimen—on his sheet of *T. inermis*, and then had supposed, when he sent me the specimen as also when he described and figured it in the Suppl. to Vol. iii. of Brit. Moss Flora, that he was dealing with the Stirlingshire plant.

Tortula inermis must certainly be erased from our list of British mosses.

DIDYMODON RIPARIUS (Aust.) Kindb.

Among the specimens above referred to from the herbarium of the late Wm. West was one labelled "*Hydrogonium Warnstorfii.* In R. Bann at Lisburn, Co. Down, July 1902; J. H. Davies; in herb. Wm. West, comm. Braithwaite."

This is a short-leaved form of *Dichodontium pellucidum*. *Trichostomum* (*Hydrogonium*) *Warnstorfii* Limpr. is a plant of somewhat similar habit, but with (*inter alia*) much smaller cells; it occurs on water-worn rocks about the Rheinfalls and in one or two other localities in Switzerland. The European plant, however, has been identified with *Hyophila riparia* Aust., and the correct naming of the species appears to be as given in the heading to this note. The determination of this Irish plant, as *Dichodontium pellucidum*, may perhaps prevent future misunderstanding. *Didymodon riparius* is not very likely to occur in Great Britain or Ireland.

DISCELIUM NUDUM Brid.

Among some mosses collected by Mr. D. A. Boyd in Scotland was a minute one which I recognized as the ♂ plant of this rare species. It was collected on a clay bank at Kilwinning, Ayrshire, in Sept. 1913; the very minute stems were remarkable for the dense agglomeration of antheridia they contained, giving the capitula a quite distinct reddish colour when viewed with the lens. This would appear to be abnormal, as Wilson and Limpricht describe the ♂ flowers as bearing *few* antheridia.

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* The labelling was "*Tortula inermis* Brid. On trees covered with mud from recurring overflow of stream—near Cowie Moss—near Stirling. Coll. Stirling and R. Kidston."

A remarkable form of DICRANUM FUSCESCENS Turn.

The late Mr. T. H. Russell, not long before his death, sent me a *Dicranum* gathered by him in July 1910 by Loch Garten, Inverness, which presents some puzzling features. The leaves are of the *fuscescens* form, with long, fine points somewhat crisped when dry, but the areolation is rather that of var. *congestum*. The remarkable feature, however, is that the capsule is practically erect and symmetrical, only the young capsules showing a very slight curvature when dry; the beak of the lid is straight and erect or slightly inclined. In all the fruiting plants in my herbarium the capsule is strongly curved, and the lid usually somewhat inclined in the same direction, so that the actual position of the lid becomes either horizontal or more frequently deflexed. Specimens in the British Museum collection show capsules with a slight approach to the present form.

I sent a specimen to Herr Loeske, who wrote (in 1911) that he considered it a form of the *congestum-fuscescens* species, of which hundreds of varieties and thousands of forms had been distinguished, and many more remained undistinguished. He did not, however, say whether the present form of capsule came under the former or the latter category! On the whole it seems best to place it under *D. fuscescens*, but it is a plant well worth further investigation.

ECTROPOTHECIUM AUSTRALE Jaeg.

Paris (Index, ed. 2, ii. 103) has the following:—

"ECTROPOTHECIUM AUSTRALE (C.M.) Jaeg. Ad. ii. p. 524 (1877–78).
Hypnum australe *C. M.* ii. p. 302 (1851).
H. limatum *H. f. & W. Fl. antarct. Suppl.* ii. p. 345 (1847) *et Fl. Tasman.* ii. p. 113 (1860).
H. terræ-novæ* *var.* australe *eor. Fl. antarct.* i. p. 142, t. 61 (1844)."

The plant in question is not, however, an *Ectropothecium*.

Hook. f. & Wils. described a plant, in Fl. antarct. i. p. **142**, from Campbell Id., as *Hypnum terræ-novæ* Brid., var. nov. *australe*. Subsequently it was found by these authors to be quite distinct, and was raised to specific rank as *H. limatum* in the Suppl. to the Fl. antarctica, ii. 345 (1847). C. Mueller, evidently in ignorance of this later development, himself raised the plant to specific rank as *Hypnum australe* (Syn. ii. 302), placing it under a Section containing other species now placed in *Ectropothecium*. Jaeger & Sauerbeck (Adumbr. ii. 524) transfer this to the genus *Ectropothecium*, doubtless not from having seen the plant but from simply concluding this to be its taxonomic position owing to its place in the *Synopsis*—on the principle of "tell me who are your companions and I will tell you what you are!"† Like C. Mueller, Jaeger overlooks *H. limatum* H. f. & W.

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* *H. terræ-novæ* Brid., omitted by Paris in the Ind. Bryolog., is a synonym of *Stereodon imponens* (Hedw.) Mitt.

† It might of course be argued that Jaeger had under his eyes a plant from Campbell I. which he took to be Hooker's plant, and which was really an *Ectropothecium*, and distinct; but that is for several reasons in the highest degree improbable.

This Campbell Island plant is no *Ectropothecium*, but an *Isopterygium*, and the correct synonymy is as follows:—

Isopterygium limatum (H. f. & W.) Broth, in Engl. & Prantl Pflanzenfam. Musci, ii. 1080 (1908).

Syn. *H. limatum* H. f. & W., Fl. antarct., Suppl. ii. 345 (1847).
H. terræ-novæ var. *australe* eor., Fl. antarct. i. 142 (1844).
H. australe C. M., Syn. ii. 302 (1851).
Ectropothecium australe Jaeg. Adumbr. ii. 524 (1877–78).

Barbula apoclada Par.

C. Mueller in Linnæa, xlii. p. 334 (1878–79) describes *Barbula subrevoluta* as a new species from Argentina. As Hampe had already published a *Barbula subrevoluta* in Linnæa, xxxviii. p. 208 (1874), Paris in the Suppl. Ind. bryol. p. 20 (1900) has re-named C. Mueller's species as above. In doing so, however, he has overlooked the fact that C. Mueller had detected the error, and had already corrected it (in his emendenda to Prodr. Bryol. Argent.) in Linnæa, xliii. p. 486 (1880–82), where he alters his former name to *Barbula perrevoluta* loco *B. subrevoluta*. Paris's *Barbula apoclada* is therefore superfluous.

Papillosity of Leaves in Schwetschkea.

I was rather surprised in examining a species of this genus collected by R. A. Dummer in British East Africa (no. 4238) to find the leaves highly papillose at back. Smooth cells are supposed to be a character of the whole family of the Fabroniaceæ, to which *Schwetschkea* belongs, and I have never seen papillose cells in any other member of the family. Otherwise the plant agreed well with the description of *S. usambarica* Broth., and on comparing it with original specimens of that species at Kew (Usambara, Holst, no. 3285) I found that the papillæ occur there, not quite so strongly, and variably, but very markedly. The papillæ are rather large, conical; they are placed at the apex of the cell, but they are somewhat of the character of those obtaining in the Bartramiaceæ; it is not at all a question of a slight prominence of the cell apex such as is common in certain genera, as *Ctenidium*, *Pseudoleskea*, and *Porotrichum*.

It may be added that there is no doubt that the plant is a true *Schwetschkea*.

Myurium Foxworthyii (Broth.) Broth.

Among some mosses sent me for determination from the herbarium of the late H. Boswell, of Oxford, was one of which the original labelling was "Dicranum [afterwards erased]. No. 2209. Cuning." A later author had added some notes ". . . . ? Leucodon vel affine." On examination I found that it was probably a *Myurium*, and further investigation showed that it was undoubtedly *M. Foxworthyii* Broth. (originally described by him as *Œdicladium Foxworthyii* in Philipp. Journ. Sci. iii. 23 [1908]), based on a fertile specimen gathered on Mt. Banajao, Luzon, by Foxworthy; afterwards placed by Brotherus in a new subgenus (*Pseudo-dicranum*) of *Myurium*. Cuming's Philippine mosses, collected about 1835, were described by Montagne in Lond. Journ. Bot. iv. 8-11, but this number is not referred to, though the adjoining ones (2208, 2210) are cited.

The plant was collected again by Robinson on Mt. Banajao, and recorded as *Myurium Foxworthyi* Broth. in Philipp. Journ. Sci. v. 152 (1910), and again in the same locality and by the same collector; as far as I am aware, these are the only records of this very rare and beautiful moss, and it seems worth while putting Cuming's plant on record. Boswell's specimen is in the Herbarium of Oxford University.

FONTINALIS IN SOUTH AFRICA.

Hitherto no species of *Fontinalis* has been recorded from South Africa. The peculiar monotypic and endemic genus *Wardia* of the Cape is the only representative of the family. Recently, however, Mr. T. R. Sim, of Maritzburg, has received a specimen of *F. antipyretica* Linn. from Miss Duthie gathered in June 1918 in some abundance, submerged in the mill-stream at Stellenbosch, Cape Province. It is not the typical form of the species, but a fairly common form with the leaves bluntly keeled, or sometimes scarcely at all keeled (approaching the var. *cymbifolia* Nicholson). Mr. Sim suggests that it has been introduced, perhaps by migratory birds, as several other northern water plants have been. Whatever the actual mode of transit, it seems pretty certain that it is a more or less recent introduction, and is likely to spread itself over the province, though as the plant is dioicous, it will probably have to be by vegetative means. The specimen sent me is possibly the ♀ plant, as I have failed to find ♂ flowers, which, when present, are usually on the upper part of the stems and conspicuous.

HYPNUM SECUNDIFOLIUM C. M.

Hook. f. & Wils. in the Fl. Antarctica, ii. 420, refer a sterile plant of Hooker's collecting, from Hermite I., Cape Horn, to *Hypnum lithophilum* Hornsch. C. Mueller (Syn. ii. 343) places it, under the name *H. secundifolium*, after the species of *Hypnum*, subsect. *Aptychus* with nerve double or 0, as being of uncertain position from want of information about the alar cells, adding the sign indicating that he had not seen the plant. Mitten (Journ. Linn. Soc., Bot. xii. 481) places it under *Sematophyllum*, sect. *Rhaphidorrhynchum*, as *Sematophyllum secundifolium*. Jaeger, followed by Paris and Brotherus, places it under *Rhaphidostegium* as *R. secundifolium* (C. M.) Jaeg.

Fairly good specimens of the Hermite Island plant are in both the Kew and British Museum collections. It is a robust plant, larger than any *Rhaphidostegium* I know, with divided stems, apparently erect, the divisions of which attain 8 cm. or more. The leaves are strongly secund, ovate-oblong, rounded at the apex and obtuse or bluntly pointed, very concave with the margins reflexed or platter-edged, or widely recurved in the lower half; the nerve double, reaching from $\frac{1}{4}$ to $\frac{1}{3}$ the height of the leaf. The cells are extremely narrow, linear-vermicular, with firm walls; gradually becoming slightly wider and more incrassate towards base, the alar forming a distinct but inconspicuous, small group of brownish, obscure, elongate, elliptic or sinuous cells with very incrassate walls.

The plant is certainly no *Rhaphidostegium*, but of Amblystegioid affinity, and I think it is almost certainly to be referred to the genus *Drepanocladus*, near *D. scorpioides*, or perhaps still nearer to *D. trifarius* (W. & M.). I think it should stand as follows:—

DREPANOCLADUS SECUNDIFOLIUS (C. M.) Dixon comb. nov.
Hypnum secundifolium C. M. Syn. ii. 343 (1851).
Sematophyllum secundifolium Mitt. in Journ. Linn. Soc., Bot. xii. 481 (1869).
Rhaphidostegium secundifolium Jaeg. Adumbr. ii. 392.
Hypnum lithophilum Hook. f. & W., Fl. Antarct. ii. 420 (non Hornsch.).

NECKERA GLOSSOPHYLLA Mitt.

Mitten described this in Musci Ind. Or. (Journ. Linn. Soc., Bot. vol. iii. Suppl. p. 119 [1859]), from specimens gathered in Sikkim by Hooker, and in the Khasian Hills by Hooker and Thomson. He compares it with *N. flabellata*, with which, however, it has no great affinity, though in habit resembling it. Fleischer in Hedwig. xlv. 78, places it in his new genus *Homaliodendron*, next to *H. microdendron* (Mont.) Fleisch., from Cochin China.

In Bescherelle's herbarium there are original specimens of *H. microdendron* of Gaudichaud's gathering from Cochin China, which I have compared with the Indian plants and find them identical. The habit varies, as it does in most of the species of *Homaliodendron*, being sometimes loosely pinnate with the branches sparingly re-branched, and at others densely bipinnate. But these variations are in no way associated with any geographical distribution. *Neckera glossophylla* must therefore fall under the synonymy of *Homaliodendron microdendron* (Mont.) Fleisch.

PINNATELLA ELEGANTISSIMA (Mitt.) Fleisch.

Mitten describes *Porotrichum elegantissimum* from Tutuila, Samoa, in Journ. Linn. Soc., Bot. x. 187 (1868). He compares it with *Neckera anacamptolepis* C. M., but with the leaves not undulate. Original specimens sent me from the New York Bot. Garden struck me as closely resembling *Pinnatella Kuhliana* (Bry. jav.) Fleisch., and on comparing them with the plant of Bry. javanica, I found them identical. Fleischer, it is true (Hedwig. xlv. 81) places the two in different sections, thus:—

"(*a*) Laubbl. oben stumpflich abgerundet, zuweilen mit aufgesetzen Spitzchen. *P. Kuhliana*.
(*b*) Laubbl. mehr. allmaehlich zugespitzt .... *P. elegantissima*."

This difference is, however, purely imaginary. The leaf apex in Mitten's type of *P. elegantissima* is precisely as figured in Bryol. javanica for *P. Kuhliana*.

Brotherus also places the two plants in slightly differing Sections, thus:—

"Aeste verflacht .... *P. elegantissima*.
Aeste nicht oder kaum verflacht .... *P. Kuhliana*."

The branches in *P. Kuhliana*, however, are to my eye quite as much flattened as in the Samoan plant; moreover, the Bryol. javanica describes *P. Kuhliana* as "folia compressa," and figures the branches as complanate, and I am clear that this is not a separating character, and that the two are identical.

This conclusion is confirmed by C. Mueller's remarks in *Musci Polynesiaci*, on *Hypnum elegantissimum* (Mitt.) C. M. There are two rather distinct forms of the Samoan plant, one with densely pinnate, stout, short branches, the other with distant, slender branches, often attenuated and filiform. C. Mueller refers to these two forms, comparing the former with *P. Kuhliana* ("gleich ganz dem . . . . . *P. Kuhliana*"), while the other he compares with *Porotrichum laxum* Bry. jav., which Fleischer has reduced to a synonym of *P. Kuhliana*!

P. Kuhliana must therefore be recognized as extending into the South Seas, including Samoa and Fiji, and New Caledonia. It is very near to *P. mucronata* (Bry. jav.) Fleisch.; the latter, however, has the leaves more constantly and more strongly mucronate, and a much weaker nerve, apart from minor differences.

GYMNOSTOMUM ORANICUM Rehm.

In my "Miscellanea Bryologica" Part vi. (Journ. Bot. lvii. 75 (1919), I referred to this moss, and pointed out that it is a true *Weisia*. Prof. Holzinger shows (*Bryologist*, xxiii. 8) that the correct citation is not, as C. Mueller gives it, *Weisia oranica* Rehm., but *W. oranica* (Rehm.) C. M., since Rehmann placed it under *Gymnostomum*, not under *Weisia*.

THE LICHEN LIFE-CYCLE.

By A. H. CHURCH.

EVEN more interesting than the significance of the somatic organization of the Lichen-type of plant is the parallel history of the origin of the mechanism of the reproductive organization, as also the progressive modification of the latter, in following the same sequence of transmigrant stages from the sea to the changing conditions of reef-pool formations, with ultimate translation to subaerial existence and conditions of extreme xerophytic exposure[1]. The complexities of reproductive organization admittedly represent the mechanism of racial continuity; and it is generally accepted that this class of phenomena affords a satisfactory guide to the relations and affinities of an organism to a much greater extent than does somatic organization which may be confused by more superficial adaptations to the immediate needs of the individual life. That is to say, the reproductive mechanism is more likely to retain vestiges of older constructions, and so to afford glimpses of previous somatic phases of the race. That such processes may be in some respects more 'conservative,' is, in fact, the general teaching of all morphology, of both plant and animal phyla, without necessarily affording any reason why they should be so. Just as, for example, as a simple matter of observation, the highest animals still retain in the spermatozoon a functional relic of the ancient plankton-phase of the sea, remote beyond even any incipient aggregation of protoplasts to a multicellular soma[1]. To what extent absolute reliance may be placed on this suggestion, is a point in question; but there can be little doubt that it has been customary in botany, for the last generation or two, to attribute an exaggerated importance to anything that could be put forward as implying sexual relations[2], again, as the inheritance of a time not so very far back when cytological sexuality in plants was still a novelty[3], the more miraculous and therefore the more important as the details and their precise significance were the more minute and often obscure. As a matter of fact, it is only within the present century that the relations of such mechanism have become sufficiently intelligible for one to obtain a comprehensive view of such racial organization and the part it plays in the story of the individual life. At the same time it will be evident that the more complex the mechanism of reproduction, the more likely it will be to present evidence of accurate adjustment to changes of the environment, as determined by the life-and-death sorting-process of natural selection, and the firmer such details will be ultimately established as racial constants, which may be altered and modified almost beyond recognition, but rarely wholly lost.

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[1] 'The Lichen as Transmigrant,' *Journal of Botany*, 1921, p. 7.

Lichens as a class are admittedly a branch of the great Ascomycete series of Fungi, using the term in the more general sense of heterotrophic plant-forms in which the most characteristic reproductive organ is distinguished as an *ascus*, with an output of normally 8 immobile spores, following an act of meiosis. The relation of this asexual construction to the familiar 'unilocular sporangium' of marine algæ (Phæosporeæ, Florideæ) is so close, and is expressed in such general terms, that the mere presence of this type of organ, without confirmatory evidence in other respects, can afford no sure mark of actual relationship. The fact that the conventional series of Ascomycetes may be really an aggregate of many older polyphyletic lines of descent, convergent in the production of an asexual sporangium of a certain limiting character, must not be forgotten[4].

I. The Case of the so-called Basidiomycete-Lichen (Mattirolo, 1881),

Though hailed with great enthusiasm as affording the final proof (if one were needed) of the dual nature of the composite construction[5], this is really of minor importance. The phenomena of intrusion are of a very elementary order; the best examples (*Cora*)[6] are obviously of quite ordinary *Thelephora*-type, with no special characters beyond those of generalized massive Basidiomycetes. These grade biologically from such cases as that of the indigenous *Polyporus igniarius* on trees, green with intrusive *Cystococcus* in patches 100 μ deep in the surface-layers, to similar cases of *Stereum*, with emerald-green colouration due to multitudes of *Chlorella* imbedded among the pile of surface-hairs, and the interesting *Clavaria mucida* of Coker[1], described as presenting the initial stage of becoming a Basidiomycete-lichen. There is little suggestion of the transfer of soluble carbohydrate in these last cases; and though the possibility of a haustorial connection is not invalidated, there is so far no experimental proof that the state of *Cora* is any better; the assumption being accepted as a stage of parallel biology and morphology. The point which such Basidiomycete examples raise, is that in a parallel group of equally massive hyphal heterotrophic Fungus-types, the special adoption of the Lichen-habit of algal intrusion, or pure parasitic fungus-attachment, should not be far more general than it is. With equal opportunities for intrusion, this can be taken to imply that the typical lichen-habit is not now to be initiated successfully under normal subaerial conditions, and presumably it never was[2]. Ordinary fungus-hyphæ at this period do not casually pick up food from adjacent algal units, and the presumption is that they can only do so exceptionally[3]. Hence the special conditions which initiated the lichen-construction must be sought elsewhere. The successful utilization of helot-algæ was apparently restricted to one very special class of transmigrant Fungi at some critical stage in their career. Phenomena of casual intrusion, and every grade of parasitic attack on algæ of higher order[4], may be attempted more or less successfully in other phyla, at different times, with suggestive results; cf. *Graphis*[5], *Laudatea*[6], *Ephebe*, *Cœnogonium*, and the case of *Pelvetia* and *Ascophyllum* never found without associated *Mycosphærella*[7]. The continued survival of a vast series of other Ascomycetous Fungi, which must have been equally transmigrant from presumably very similar marine conditions, and yet present no indication whatever of algal intrusion (cf. *Xylaria*)[8], should suffice to show that the algal prototypes of the more distinctive Lichen-fungi may be distinguished from Ascomycetes in the narrower sense, as the representatives of a parallel group of transmigrant algæ, convergent with other more saprophytic genera in certain respects.

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[1] 'The Building of an Autotrophic Flagellate,' Bot. Mem. i. 1919, p. 14.

[2] Sachs (1874) *Textbook*, Eng. Trans. (1882) p. 284, 'Carposporeæ.'

[3] Hofmeister (1851) for the Fern, Bornet and Thuret (1854) for *Fucus*.

[4] Strasburger (Eng. Trans. 1912) *Textbook of Botany*, p. 389. Reliance on cytological details proves equally illusory.

[5] De Bary, Comp. Morph. Fungi (Eng. Trans. 1887), p. 419.

[6] Zahlbruckner (1907, in Engler and Prantl), p. 239; *Cora* can live without the alga.

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[1] Coker (1904), Bot. Gazette, 37, p. 62.

[2] *Cf.* Bonnier's observations on Lichen-spores germinating in association with the protonemata of Mosses (Rev. Gén. Bot), 1889, p. 165, t. 8.

[3] Special interest attaches to the case of the secondary fungus-interloper, as when an ordinary Ascomycete is parasitic on an established Lichen, as *Homostegia Lichenum*, and *H. Piggottii* on *Parmelia saxatilis*.

[4] *Cf.* Bonnier (1889), *loc. cit.*

[5] De Bary (Eng. Trans. 1887), p. 399.

[6] Möller (1893), Flora, p. 254; p. 277: summarized in Kerner (Eng. Trans. 1895), 2, p. 695.

[7] Cotton (1908), Trans. Brit. Myc. Soc. p. 95; Sutherland (1915), New Phyt. p. 33. I am indebted to Mr. Marshall A. Howe for drawing attention to the case of fungus with sea-weed in *Blodgettia confervoides* Harv. (= *Cladophora fuliginosa* Kütz.), and also the cases of *Siphonocladus rigidus* and *Petrosiphon adhærens*.

[8] *Cf.* also the fine algal form of *Cordyceps Taylori*: Kerner (Eng. Trans. 1895), 2, p. 679.

II. The Case of the Ascomycete.

Thanks to the very complete observations of Claussen on *Pyronema confluens*[1], the general framework of the life of a typical holosaprophytic Ascomycete can be now presented in a clear and logical manner. The complications consequent on a decadent cytology have been demonstrated in detail, and the confusion introduced by previous observers has been cleared up[2]. The life-history reduces to a readily intelligible and simple *two-phase* alternating sequence, in which a sexual generation (gametophyte) exhibits phenomena, however decadant and autogamous, of fertilization *in situ*. This is followed by the development of the zygote, permanently nourished by the parental tissues, to an asexual phase (asco-sporophyte), not only wholly parasitic on the gametophyte, but protected and fed by the latter. to the extent that it reduces to the status of practically a mere asexual reproductive tract, devoted to the indefinite production of uniloculor sporangia (now termed *asci*) each with a uniform output of eight ascopores. This ascogenous tract presents the appearance of a hymenial layer, with paraphyses as nutritive ramuli of the parental mycelium ranging among the ascogenous ramuli[3]. The inter-relation of the ramuli of the two generations may be complex to a degree; but the somatic tissues of the asexual plant are reduced to the merest minimum of a few connecting 'ascogenous hyphæ.' In many larger 'fructifications' the conjoint hymenium may be relatively enormously developed (*Gyromitra*, *Morchella*, *Geoglossum*, *Peziza*). The sexual gameophyte keeps pace with the enlargement of the ascogenous tract, and the production of asci may be continued indefinitely. Such a two-phase cycle of alternating gametophyte and superposed sporophyte—the former presenting phenomena of sexual fusion, the latter of meiosis—so closely follows the life-cycle evolved by many phyla of marine algæ, that not only is the theoretical relation sufficiently definite, but it is at once obvious that such a life-cycle in Ascomycetes of the land must have been inherited from comparable algal ancestors in response to similar conditions of marine environment. Since the story of the algal progression in the sea itself is quite clear, and there is no suggestion as to how such identity of organization could have been produced in response to a complex of largely different subaerial factors. The origin of the fungus from sea-weeds is more inherently probable than that of the sea-weed from fungi, and invocations of the 'long arm of coincidence' merely negative scientific investigation.

Following the ordinary interpretation of the facts, as based on such simple algal antecedents, it should be now possible to analyse the organization of a saprophytic Ascomycete, and place it in its proper relation to other plant-groups of comparable status and with similar transmigrant origin. It is therefore important to realize that such a complex life-cycle, having attained to fertilization *in situ*, and a two-phase sequence accurately adjusted to a condition of alternation by cytological mechanism, can only supervene in plants of high-grade specialization in other respects. That is to say, with complex somatic elaboration, as characteristic of fairly large and efficient autotrophic forms, with morphological differentiation of members and anatomical differentiation of tissues, as physiological division of labour attains a perfection as great (*mutatis mutandis*) in the life of the individual, as is the part played by the complexities of reproductive mechanism in the life of the race [1]. In such advanced organism the successful secondary assumption of the heterotrophic habit involves the loss of all peripheral photosynthetic tissues, and any mechanism implied by older conditions of surface-nutrition. The soma is reduced to the merest skeleton of 'mechanical hyphæ,' as what may be termed a 'skinned alga'; though possibly long retaining evidence of ramification, older somatic form-factors, or the differentiation of reproductive tracts (cf. *Xylaria*). In the limit it reduces more and more to an amorphous mass of interwoven hyphæ (*Pyronema*), the 'thallus' of older writers [2], or to the merest weft of a few mycelial filaments, in ultimate stages of parasitic deterioration on, or even within, the active tissues of the foliage-leaves of higher land-plants (*Sphærotheca*, *Exoascus*). These and other limiting extremes of the series have attracted considerable attention in the past, owing to the unfortunate obsession of land-botanists for confusing the apparently 'simple' with the 'primitive.' The phyletic value of all such residual heterotrophic organism of the land is considerably discounted once the autotrophic marine origin of all land-vegetation is recognized; as also the fact that the greater the complexities of the subaerial transmigration, the more abundant and aberrant will be such vestigial forms as the debris of lost races.

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[1] Claussen (1912), *Zeitschrift für Botanik*, p. 1.

[2] Guilliermond (1912), *Rei Progressus*, p. 511; Faull (1912), Ann. Bot. p. 346.

[3] De Bary (Eng. Trans. 1887), p. 186. for scheme of *Ascobolus*. Guilliermond (*Rei Progressus*, 1912), p. 515, for *Pyronema*.

While the deterioration of the somatic region is to be found in every grade, the organization of the reproductive processes may remain comparatively unaffected; since the latter were originally tending to be the more heterotrophic as more specialized, and so the more dependent on food-material derived elsewhere. Thus *Pyronema* presents vestigia of what might pass for quite definitely differentiated antheridia and oogonia as 'unilocular gametangia'; though these now grow closely adjacent, with their mechanism for the discharge of flagellated gametes wholly eliminated. With the latter has also gone any possibility of cross-fertilization. An older condition of oogamic fertilization *in situ* (conceivably on the lines of *Achlya*, still with many oospheres) has been superseded in favour of autogamous siphonogamy by means of a conjugation-tube[1]. With the deterioration of the sexual units, fertilization-mechanism is reduced to the merest expression of the pairing of conjugate nuclei and the production of a communal zygote; the essential features of karyogamy being indicated to the extent that the developing zygote may be still regarded as a diploid phase. It is sufficiently clear that however residual the phenomena of syngamy, the method is only a deteriorated version of the familiar algal prototype, in which similar organs once emitted flagellated zoïd-gametes in the plankton-phase of the free medium of the sea. So far is the common story of the text-books[2].

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[1] This generalization has been much obscured by land-botanists confined to the consideration of the last and most depauperated algæ of fresh water (*Coleochæte*, *Vaucheria*), in which advanced condition of reproductive mechanism may be associated with extreme somatic decadence. The same applies to common moulds, as *Eurotium*, *Penicillium*, and limiting phrases of parasitic habit on foliage-leaves (*Sphærotheca*, *Exoascus*, Uredineæ, etc.).

[2] Schleiden (Eng. Trans. 1849), p. 157; Sachs (1874), Eng. Trans. 1882, p. 231.

The further development of the alternating asexual stage (sporophyte), follows lines of complete parasitic decadence and dependence on the parental mycelium. The entire strength of the organism is devoted to the reproductive function, and asexual sporangia in which meiosis has been intercalated, express the first limiting phase of reduction in spore-output, as the two divisions of meiosis are followed by a limit of *one* normal mitotic division only, giving a total content of eight spores[3]. The collocation of such sporangia in a hymenial layer is but the commonplace of algal construction (*Chorda*, *Laminaria*); the provision for continual output of new asci, maintaining the level of the older units is ingenious in its cytology, but the intercalation of meiosis in such asexual organs again follows similar sea-weed rules (as in *Aglaozonia*). Not only is the reduction of output directly paralleled in *Aglaozonia*[1], 8 (32–16), and in *Zanardinia*[2], 4, following increased volume of the flagellated zoïds; but the production of immotile spores, replacing flagellated zoïds, is the commonplace of the Phæophycean *Dictyota*, as also of the tetrasporangia of the Florideæ. It is thus easy to see behind the normal production of a simple apothecium the last vestigia of the morphological details of a mechanism initiated in response to the biological factors of the sea; and there is not the slightest reason to assume gratuitously that such features can be ever reconstituted *de novo*, under any other set of biological factors, merely because in the present condition of the world it has become a commonplace of transmigrant organism.

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[1] The fact that the conjugation-tube is produced by the oogonium, and not by the antheridium as in *Pythium* and *Saprolegnia*, has led to the suggestion of its being a vestigial 'trichogyne.' A trichogyne with functionless spermatia is found in *Polystigma* (pseudogamous), and a more definite one of 4–6 cells in *Lachnea* (parthenogamous). There can be also no doubt that many types presenting 'Woronin's hypha' have lost a trichogyne-mechanism (cf. *Xylaria*); so that different methods of fertilization obtain within the conventional group, and express the secondary nature of these processes. But while there can be no question as to the decadence of the mechanism, the point remains as to what was the prototype of which these phenomena are such highly modified vestigial expressions. Noting again that it is not parasitism *per se* but *autogamy* which induces deterioration in the sexual process: parasitism only affects the somatic tracts.

[2] Strasburger (Eng. Transl. 1912), p. 380, *Monoblepharis*.

[3] The remarkable capacity of the eight spores of the ascus for further septation always attracts attention, particularly as it is equally characteristic of the ascospores of Lichens and Laboulbeniaceæ, though wanting in the unilocular sporangia of the sea; while it is equally clearly not the expression of precocious germination. The solution of the problem appears to lie in the fact that the 'spore-origins,' which invest with a firm spore-coat, are delimited after the first normal mitosis, and whatever subsequent mitoses occur, the number of primary spores is determined by this early isolation of perennating units with the characteristic spore-membranes of land-flora. From such a standpoint the precocious initiation of the exospore of land-flora, which takes some time to differentiate, introduces a time-factor into the progression. Admitting such septation as normally continued, the biseptate spore would be a limiting case: such biseptate spores are characteristic of many small Ascomycete types (*Mycosphærella*) and Lichens (*Physcia*), and become the general rule in Laboulbeniaceæ.

Similarly all phases of further elaboration of the asexual stage, as it comes to be increasingly immersed in the parental tissue, protected beneath the surface in perithecial chambers, and provided with ostiolar mechanism of control for the regulation of spore-dispersal—constituting the organization of the conventional series of the Pyrenomycetes, as opposed to apothecial Discomycetes,—are again mechanisms of marine inception. Identical phases are traced in existing Florideæ, in which all such problems of the nutrition of countless 'cystocarps,' on or in the branches or laminæ of the parental soma, work out the same features of physiological and morphological organization. Again, in a manner which admits of no other interpretation, but that all plants presenting such construction must have had the same initial stimulus, and the same effective benefit, in order to establish the same homoplastic result; though now the spores of the Fungi may be normally wind-borne, and present the cuticularized exospore of subaerial vegetation; later xerophytic adaptations of the land being superposed on an older marine mechanism.

That minor variations on such a theme should occur—as, for example, complete failure of the perithecial wall to give the ostiolar mechanism to a decadent cleistocarpic construction—need excite no special remark; nor again that the most minute and extreme cases of holoparasitism on the leaves of higher plants should give reproductive organs reduced to the limit of the uninucleate stage, or an asexual phase with only a single ascus (*Sphærotheca*). Such would be the normal progression of deterioration, and the extreme nature of the biological factors supplies a sufficient cause. Similarly the complete loss of differentiated sexual organs in a mechanism now wholly autogamous is intelligible, as also all conditions of apogamy, parthenogamy, and pseudogamy[4].

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[1] Yamanouchi (1912), Bot. Gazette, 54, p. 472.

[2] Yamanouchi (1913), Bot. Gazette, 56, p. 23.

[3] There is in fact no knowledge of how a plant could be evolved on the land only as a true 'land-plant,' when it is accepted that all land-life, both plant and animal, must have been transmigrant.

[4] Guilliermond (1912), *Rei Progressus*, pp. 491, 493.

(To be continued.)

SHORT NOTES.

Carex pulicaris forma montana (see page 103).—On June 5th, 1915, I was yet another field-botanist puzzled by a form of *C. pulicaris* with erect fruits and short stems. It was growing in great quantity on the rather damp N.E. shoulder of Crook Peak, Somerset, at an elevation of about 500 feet. This is the limestone spur of the Mendips nearest the sea, which, though only 628 ft. high, forms so conspicuous an object from the G.W.R. between Yatton and Highbridge. I gathered numerous specimens, some of which I distributed, but on mounting a good series I could find nothing but *pulicaris* in the sedge. After reading Mr. Pugsley's account of his *forma nova*, I referred to my specimens and find all those from Crook Peak are of this dwarf, erect-fruited form. They are 8–12 cms. high, with strong tufted roots. The same day I collected typical *pulicaris*, with fruits already reflexed and most of the lower bracts fallen, in Max meadows, Winscombe, immediately below the aforesaid hill; they average 18 cms. in height. On reference to my diary of 1915 I find June 5th followed a three weeks' drought. But specimens with erect perigynia from a thicket on limestone by Durdham Down, Clifton, Bristol, gathered 25 June, 1916, are 17–27 cms. high, though with the strongly-ribbed stems of the Mendip plant, which are rather thicker and less filiform than those of the plains. The height of the Durdham Down specimens may be accounted for by the fact that they grew at the southern edge of a rather dense thicket. Both my Mendip and Durdham Down specimens confirm the persistency of the bracts, described by Mr. Pugsley. It is probable that several more of the upland localities for *pulicaris* mentioned in White's *Flora of Bristol* will prove to come under the montane form; at least we now know that the form is not peculiar to the high mountains, and can substantiate Mr. Pugsley's supposition in regard to some of the Clifton plants. All the spikelets of the *forma* agree in being distinctly shorter than those of the type collected on the same day, and both my Mendip and Durdham Down specimens of *montana* exhibit the persistency of the bracts. On the Continent I do not remember having seen *C. pulicaris* at a greater elevation than 6400 ft. or 1920 m. This was in the swamp round the lake at Mont Cenis, where it is associated with the closely allied *C. microglochin*, Wahlenb. and with *C. dioica* and *C. Davalliana*. Jaccard says (Cat. de la Flore Valaisanne, 1895) of *pulicaris* in Canton Valais "très rare ou peu observé. 380–1800 m."; whereas the range of *C. rupestris* in that very mountainous area is given as 1600–3100 metres.—H. Stuart Thompson.

Epipactis leptochila Godf. The plant described as *E. viridiflora* Rchb. var. *leptochila* (Journ. Bot. 1919, p. 37) can no longer be regarded as a variety of Reichenbach's species. The latter is identical in the morphology and functions of the reproductive organs with *E. latifolia*, of which it forms a subspecies, race, or variety, according to the views of different authors; *E. leptochila* differs from this in exactly the same way in which it differs from typical *latifolia*. It is equally certain that *leptochila* is not a form of *E. Muelleri*, as a comparison of the descriptions of the two plants will easily show. There is no European species of *Epipactis* under which *leptochila* could, with any show of reason, be placed as a variety. It is therefore unavoidable to raise it to the rank of a distinct species as **E. leptochila** Godfr. The position of *E. viridiflora* var. *dunensis* and also the variety *vectensis* will similarly require reconsideration.—M. J. GODFERY.

REVIEWS.

La Botanica. By AUGUSTO BÉGUINOT. Roma 1920, pp. 116; 3·50 lire.

EVERY day it becomes more important for the students and scientific workers of our country to know something of what is being done in other lands. We therefore have no hesitation in recommending to English botanists this little book, which is as well done as the author's name would lead us to expect.

The first forty-three pages comprise an account of modern botanical work in Italy, whilst the remaining seventy-two are occupied by a bibliography (admittedly not exhaustive) of Italian publications in every branch of botany during the last fifty years. The volume has been compiled by Prof. Béguinot for the series of "I. C. S." guides, or "Bibliographical profiles of the Italy that writes," published by the Istituto per la Propaganda della Cultura Italiana. There are chapters on (1) Italian Botany in the first seventy years of the last century; (2) Schools and the tendencies of study since 1870; (3) The development of Italian Botany during the last fifty years; (4) Scientific organization and initiatives of a social character.

In tracing the revulsion from the almost exclusively systematic or descriptive Botany of the first period, associated with the names of Tenore, Bertoloni, Parlatore, Gussone, Moris and others, in favour of anatomical, physiological and biological research, Prof. Béguinot pays a well-deserved tribute to the genius of Federico Delpino, though he fails to remind us that for Delpino the valuable collections of the Naples herbaria, containing the types and other treasures of its predecessors, were nothing but "so much stale hay."

While the late Prof. Saccardo stands at the head of cryptogamists, the first place among Italians who have worked on exotic Floras is rightly assigned to Odoardo Beccari, whose recent death England almost equally with Italy deplores. The section on the origin of species and the doctrine of evolution reveals—perhaps unconsciously—how much less attention these fascinating problems have attracted in Italy than in this country.

Of great interest for English readers is the too brief account of living botanists and the work on which they are engaged. We may remark that nearly all botanical workers in Italy are men of small means, to whom the attainment of posts in the State hierarchy of teachers is essential. To compete successfully for such positions it is almost always necessary to have published treatises or papers in several different branches of the science, a requirement which has a two-sided influence, injurious on the one hand as tending to produce "Jacks of all Trades" and superficial work in subjects which are not the writers' real interest, but on the other advantageous as securing a wider scientific view than is always possessed by specialists.

The bibliography alone is more than worth the price of the volume, and will be found handy and useful even by those who cannot read Italian with sufficient ease to appreciate Prof. Béguinot's essay. C. C. L.

Sable Island.

The latest issue (no. lxii; March 14) of Contributions from the Gray Herbarium is devoted to an interesting and exhaustive account of Sable Island, Nova Scotia, by Mr. Harold St. John, who visited the island in the summer of 1913. Sable Island was known to the fishermen of Western Europe at the beginning of the sixteenth century; the earliest reference to its vegetation is that by Johannes de Laet (1585–1649), who recorded the occurrence on the island of a few native trees, of which it is now entirely destitute. The first botanist to visit the island was the late John Macoun, who stayed there for five weeks in 1899 and made collections, of which he published an account in the Report of the Canadian Geological Survey; the catalogue of the vascular plants which follows the introduction includes Macoun's and other collections.

The native flora consists of 147 species, varieties, and forms, of which several are new—among them a new bramble (*Rubus arcuans* Fernald & St. John); of these figures are given; there are also 51 adventives and 15 planted species. The list contains numerous interesting notes—*e. g.* that on *Arenaria peploides* var. *robusta*: of this it is difficult to collect good specimens, as the plant is "the choicest fodder of the gangs of wild ponies that roam the island, and as these total anywhere from two to four hundred ponies, it is easy to see how they would make serious depredations on any plant growing only in a limited portion of an area of about fifteen miles square. I myself tried munching a sprig of the *Arenaria* and found it of good texture, juicy and with a strong but not unpleasant taste resembling that of cabbage." *Lathyrus maritimus*, the abundance of which has been noted by all travellers since 1633, is "an able ally of the Sand Grass [*Ammophila breviligulata* Fernald] in its perpetual defensive against the eroding forces that threaten to destroy the island." *Calluna vulgaris* is adventive but not well established; it was probably used for or carried in the packing round trees imported from a French nursery; Mr. St. John says that Macoun did not find it, but Mr. Arthur Bennett (Journ. Bot. 1901, 198) writes: "Prof. Macoun has sent me specimens from Sable Island, just such as one might gather on a Scottish moor."

The catalogue is preceded by ecological observations and followed by an excellent bibliography; the paper is, in fact, a model of the way in which such things should be done.

BOOK-NOTES, NEWS, ETC.

THE news of the death last year of two prominent Canadian botanists—father and son—has only lately reached us. JOHN MACOUN, who died on July 18 at his residence in Sidney, Vancouver Island, British Columbia, was born near Belfast on April 17, 1832, and came to Canada with his parents in 1850. In 1882 he became professor of Natural Science at Belleville, Ontario, and naturalist of the Geological Survey of Canada. He published numerous papers on Canadian plants, including a report on those collected during the Canada Geological Survey under Dr. Robert Bell in 1877–81, of which he presented a large number to the National Herbarium; in connection with the Survey appeared his most important work—a *Catalogue of Canadian Plants* in seven parts (1883–1902), in which he was assisted for the Mosses by N. C. Kindberg. Macoun, who was a good all-round naturalist and an ornithologist of note, lived in Ottawa until 1912, when failing health caused him to move to the milder climate of British Columbia; here he continued to work until his death, especially at mosses and fungi. His eldest son, JAMES MELVILLE MACOUN, was born in Ottawa in 1862, and died there in January, 1920: he assisted his father for about forty years and became botanist and chief of the Biological Division of the Geological Survey; in 1899 he published a *List of the Plants of the Pribilof Islands*, which he visited in 1891 and 1897. For much of this information we are indebted to a notice by R. M. Anderson in the *Journal of Mammology* for February last.

AT the meeting of the Linnean Society on April 7th, Mr. Horace W. Monckton read a paper "On the Distribution of *Taraxacum erythrospermum* Andrz., in the South-east of England." The author explained that he had for some years noticed a small form of Dandelion with deeply cut leaves and red seed growing abundantly on a football ground at Wellington College, Berkshire. It belongs to a group of varieties named *erythrospermum*. The geological formation is Upper Bagshot Sand (Barton Beds). He had seen the same variety on the similar sandy soil of Puttenham Heath, Surrey (Lower Greensand), on the Thames Gravel near Old Windsor, Berks, and on walls at West Drayton and other places. It is not confined to areas of sand or gravel, for he exhibited specimens from the London Clay of Ashtead Common, near Epsom, Surrey. He had also found the same variety on the North Down at Ranmore Common, near Dorking, which is in the Chalk District. The chalk does not, however, form the surface at that place, there being a covering of some thickness of clay, sand, and stones (mapped "Clay-with-Flints"). The only example of the red-seeded variety which he happened to have seen growing actually on a chalk soil was in a field between Leatherhead and Headley, Surrey. It is a larger plant than his other examples and is determined by Dr. Druce as *T. lacistophyllum* Dahlst.

At the same meeting Mr. Reginald A. Malby gave a lecture on "A miniature Alpine Garden from January to December," illustrated by a long series of lantern-slides, many of them coloured.

A NEAT little volume by Mr. Forster Robson—*Wayside Trees and How to Know them*—comes to us from Messrs. Thornton Butterworth (7*s.* 6*d.* n.). "The trees are arranged according to the general form of their leaves—an arrangement," says the author, "very shocking to the botanist, but materially helpful to the ordinary man," who must thus be content to know trees only when the leaves are expanded. The treatment of leaflet as equivalent to leaf leads to odd combinations: thus, "Trees with oblong leaves" are divided into "leaf serrate: Rowan, True Service, Apple; leaf entire, Box, Holm Oak." The book is fully illustrated by the author; the cuts in the text are quite good, the plates please us less. The very narrow margin gives the well-printed pages an ugly appearance, but the volume is of convenient size for the pocket.

THOSE who want a fuller and more satisfactory treatment of our trees will do well to obtain from the S. P. C. K. the latest (eleventh) edition of C. A. Johns's *Forest Trees of Britain* (14*s.* n.)—a book which, first published more than half-a-century ago, has been revised by Mr. Boulger, who performed a similar office for the same author's *Flowers of the Field*. The present edition has plates taken by photography in the natural colours: of the general accuracy of the text there is no need to speak. The book is so good and must have recouped its publishers so fully that we venture to suggest a resetting for the next edition, and the substitution of better text-figures for those which, excellent at the time they were first published, have become somewhat obsolete in style.

The Essex Naturalist (xix. pt. 4: Oct. 1920–March 1921) contains a long and interesting paper by Mr. Percy Thompson on "Another Annotated Copy of Warner's *Plantæ Woodfordiensis*"; a paper by the same author similarly annotated appeared in part 2 of the same periodical (see Journ. Bot. 1920, 95). The copy was formerly in the possession of Edward Forster, whose notes therein are transcribed, and of whom a portrait, reproduced from the oil painting at the Linnean Society, is given. In the same part Mr. Miller Christy writes on "Æneas MacIntyre, a Forgotten Essex Botanist," who will form the subject of a future note.

MR. J. M. BLACK sends us copies of his "Additions to the Flora of South Australia," reprinted from Trans. Roy. Soc. S. Australia, xliv. (1920), in which are described and figured two new Acacias (*A. rhetinocarpa* and *A. prolifera*) and a new *Stipa* (*S. horrifolia*); and also a revision of the Australian *Salicorniæ* from the preceding volume of the same Transactions. The name *Salicornia australis* should be cited as of Bentham (Fl. Austral. v. 205); Solander's name in Forster's *Prodromus* is, as Bentham points out, a *nomen nudum*, and J. D. Hooker's citation for the name as of Banks and Solander occurs in synonymy, and is hence not entitled to recognition. It may be noted that the MS. description and figure to which Hooker refers relate to the New Zealand plant; the volume of *Illustrations* mentioned by Mr. Black is limited, as its title shows, to Australian plants.

Mr. C. T. White, Government Botanist of Queensland, sends us reprints which show much activity in the investigation of the flora of the colony. A revision of Queensland *Lecythidaceæ* (Proc. Linn. Soc. N.S.W. xliv. 1919—issued March 15, 1920) includes a new *Barringtonia* (*B. longeracemosa*); "Contributions to the Queensland Flora" (*Botany Bulletin*, xxii.; 5 Aug. 1920), in which Mr. W. D. Francis cöoperates, contains descriptions and figures (from photographs of specimens) of numerous species of *Sapindaceæ*, *Myrtaceæ*, *Meliaceæ*, etc.; the first number of "Contributions to the Orchidaceous Flora of Queensland" (Proc. R. Soc. Queensland, xxxii: Sept. 14, 1920) includes two new Zeuxines (*Z. oblonga* and *Z. attenuata*), jointly described by Mr. White and Dr. R. S. Rogers.

We take the following from the *Manchester City News* of Feb. 5: "The Middleton Botanical Society, which has been in existence for considerably more than a hundred years, held its annual dinner on Saturday last at the Ring o' Bells, the guests of the evening being Mr. J. W. Whitworth and Mr. William Henry Pearson. Until the war the society had the curious custom of regaling itself at its annual dinner with hot ale and gin—a custom which, however, no longer prevails. After dinner the chair was taken by Mr. Thomas Entwisle, the president, a gardener under the Corporation, at Queen's Park, whose knowledge of British and exotic plants is perhaps unrivalled in the kingdom. In his address he gave some very interesting particulars as to George Caley, an early member of the society, who went out to Australia with Sir Joseph Banks and who, after being there about ten years, was recalled to England to give evidence in relation to the Mutiny of the Bounty. He afterwards was appointed superintendent of the Botanical Gardens at St. Vincent in the West Indies. . . . Mr. Pearson expressed the proud pleasure he had in meeting the members of a society which could claim to have had such distinguished Lancashire botanists as George Caley, Edward Hobson, Richard Buxton, and others, and whose reputation is being well upheld by such of its present members as Mr. Searle, Mr. Rouse, and Mr. Entwistle. Mr. Pearson mentioned that he had lately met with a copy of Priscilla Wakefield's 'Letters on Botany,' which, according to the autobiographic sketch of the author, was one of the few books which Richard Buxton had to help him in his studies. This Mr. Pearson had the pleasure of adding to the considerable library possessed by the society."

Further parts of the *Synopsis der Mitteleuropäischen Flora* (continued after Ascherson's death by Graebner) forming the beginning of vol. v. 2, will be useful to students of British plants. In Part 100 (30 July, 1920) we find *Agrostemma Githago*; *Coronaria Flos-cuculi* (the genus *Lychnis* as emended includes no British species); *Melandryum album* and *rubrum* (=*dioicum* L. emend. Miller, as *Lychnis*) and their hybrids; *M. noctiflorum*; *Viscaria viscaria* (=*V. viscosa*) and *alpina*—all except the last with numerous subdivisions and names: *Silene venosa* (Gilibert as *Cucubalus*, nomen abortivum, =*S. angustifolius* Mill. emend. Rendle and

Britten. = *S. Cucubalus* Wibel for those who exclude the narrow leaved southern plant) occupies twenty pages. Part 101 (30 Dec. 1920) contains *S. maritima* (E. J. Salisbury's flower forms are noted, with others); *S. conica* (little variable) and *S. gallica* (including *anglica* and *quinquevulnera*). The *Synopsis* does not recognize the International Rules of Nomenclature as binding, preferring to continue as it began. The use of such terms as lusus (indicated by "l.") and monstrositas ("m."), the inclusion of such forms among the more normal variations, and the mention of artificial hybrids made by Gaertner &c. (e. g. *Melandryum rubrum* × *M. noctiflorum* and × *Coronaria Floscuculi*, *Silene venosa* × *maritima*), all commend themselves to students of variation, but the impression is left that we are still dealing with an unassorted compilation of names rather than with an attempt to give a modern view of the variation within the species. This latter is left to the reader, but one feels that some of the Jordanian so-called "microspecies" so slavishly perpetuated in Rouy and Foucaud's *Flora de France* might be allowed to remain buried unless they had shown some of the usual signs of life. Middle Europe seems to be an elastic term which includes the Balkan Peninsula at least as far as Thessaly, Podolia in Russia, Sweden and Finland. The use of square brackets for forms which do not occur in Middle Europe would be useful.—A. J. W.

THE *Journal of Ecology* (Dec. 1920, issued Feb. 9) contains papers on "The Aquatic Vegetation of the English Lakes," by W. H. Pearsall; "The Significance of the Calcicolous Habit," by E. J. Salisbury; "Changes in the Salt Marsh and Sand Dunes of Norfolk," by S. M. Wadham; "Notes on the Habitats and Ecological Characters of three subvarieties of *Festuca rubra*," by W. O. Howarth. The subvarieties are *grandiflora* and *glaucescens* of Hackel, and *tenuifolia*, described by the author in his previous paper (1919); the observations were made on the coast of Glamorgan.

THE *New Phytologist* (xx. no. 1: March 24) contains papers on "Carbohydrate Production in the Higher Plants," by F. F. Blackman; "Heterothallism and Similar Phenomena," by E. M. Cutting; "Suberin and Cutin," by J. H. Priestley; "The Theory of Geotropic Response," by V. H. Blackman. Mr. Francis Darwin continues his "Studies in Phænology" for 1920; the observations, as those for 1917–19, with which they are compared, were chiefly made at Brookthorpe in Gloucestershire, but some in Cambridgeshire and near Gomshall, Surrey.

The Botanical Gazette (Chicago) for February contains papers (with figures) on the "Development of Head and Flower of *Dipsacus sylvestris*," by Hilary S. Jurica, and "A Chemical and Physiological Study of the Mottling of Leaves," by F. M. Schertz.

WE greatly regret to announce the death of Mr. R. A. Rolfe, which occurred at his residence at Kew on April 13, after a long illness: we hope to publish some account of his work in our next issue.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species: the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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PLANT NOMENCLATURE: SOME SUGGESTIONS.

By T. A. Sprague, B.Sc., F.L.S.

Fifteen years have elapsed since the adoption of the International Rules for Botanical Nomenclature by the Vienna Congress, and the time now seems ripe for an enquiry into their working and as to what amendments, if any, are required.

The International Rules have been accepted by a great majority of botanists, but many in the United States adhere in preference to the American Code (Bull. Torr. Bot. Club, xxxiv. 167; 1907.—*Science,* n. s. xlix. 333; 1919: lii. 312; 1921). The professed objects of the two sets of rules are superficially similar. The chief aims of the International Rules are: 1, to secure fixity of nomenclature; 2, to avoid names which may cause error or ambiguity; 3, to avoid useless creation of names. The primary object of the American Code is to secure stability, uniformity, and convenience in nomenclature. But unfortunately "fixity" and "stability," as used above, have very different meanings. The International Rules are designed to preserve established generic nomenclature as far as possible, whereas the American Code requires its rejection whenever it conflicts with strict priority. A rough idea of the number of name-changes required under the Code may be gained from the total number of species affected by the "nomina conservanda" of the Rules. These amount to more than 15,000 out of a total of 136,000 Seed-Plants; that is to say, one species out of every nine. The figures are taken from Dalle Torre et Harms, Gen. Siphonog. (1900–7); and Thonner, Blütenpfl. Afr. 623 (1908).

Regarded theoretically, the American Code is simpler and more consistent than the International Rules; but those who consider nomenclature not as an end in itself, but as an aid to the advancement of science, may well hesitate to accept a Code which in practice requires the replacement of many thousands of well-known names by new or unfamiliar ones.

The strict application of the principles of priority would render the botanical data accumulated in the past less accessible even to the professional systematist, and add enormously to the burden of synonymy which impedes the progress of botany.

Some capital has been made of the alleged non-representative character of the Vienna Congress, and it may be admitted that, owing to geographical reasons, the botanists of America and Western Europe were relatively sparingly represented. That, in spite of this, the International Rules should have met with general acceptance, is a clear indication of their reasonable and practical character.

The great and constantly increasing divergence in nomenclature between those who accept the International Rules and the adherents of the American Code is a matter of grave concern to all botanists of whatever views. Unless some agreement is reached, the systematist of the future will have to make constant use of a generic concordance. Two examples may suffice: in thirty years, 1886–1915, the new species and combinations published under *Corydalis* numbered 156, whilst there were 117 under the prior name *Capnoides*. In the twenty years 1896–1915, the new entries under *Rhynchosia* amounted to 93, and those under the prior name *Dolicholus* to 57. Thus in two genera alone the number of names to be rejected is 174 under the International Rules, and 249 under the American Code, out of a total of 423 published names.

It should not prove impossible to arrive at an agreement by means of concessions on both sides. As regards the International Rules, Art. 36, which treats new groups published from 1908 onwards as invalid unless accompanied by a Latin diagnosis, might be revoked or altered to a recommendation. Secondly, specific names which are homonyms might be treated as invalid. On the other hand, the American Nomenclature Commission might accept the lists of generic " Nomina Conservanda " adopted by the International Congresses at Vienna and Brussels. In the second place they might reconsider the question of "priority of place," in view of the undesirable results to which it frequently leads (Kew Bull. 1920, 318). Should no agreement be reached, systematic botany will be burdened before long with a current dual nomenclature affecting at least one species out of every nine.

Certain changes in and additions to the International Rules are now proposed for adoption at the next Congress. It is claimed that these are in harmony with the general spirit and aims of the Rules.

Attention may also be directed to the rules for fixing generic and specific types, recently incorporated in the American Code (*Science*, n. s. xlix. 333; 1919: liii. 312; 1921).

REVOCATION OF ART. 36.

1. Article 36 should be revoked. It makes the validity of publication of a new group contingent on its being accompanied by a Latin diagnosis. Even those who prefer Latin descriptions may agree with the American Nomenclature Commission in regarding this Article as "arbitrary . . . . unnecessary and unwise" (Bull. Torr. Bot. Club, xxxiv. 168; 1907). The average botanist will accept a name accompanied by a description in any language which he can understand; and it would be futile, even were it desirable, to try and treat all the English descriptions of new species and genera published in North America since 1908, for example, as non-valid.

Descriptions published solely in Slavonic or Oriental languages, being unintelligible to the average botanist, will be ignored in any case, unless they are made known in some other way, *e. g.* by a figure, or by the distribution of authenticated specimens to the principal herbaria of the world.

To treat thousands of names of new groups described in well-known European languages as non-valid on the ground of the absence of Latin diagnoses merely opens the door to the " useless creation of names" condemned in Art. 4. Under Art. 36, there is nothing, apart from common-sense and good taste, to prevent wholesale piracy of new groups by the simple expedient of changing their names and supplying short Latin descriptions.

The majority by which Art. 36 was passed was so small that a transference of nine votes would have led to its rejection: 105 voted in its favour and 88 against (Act. Congr. Bot. Vienne, 131; 1906).

NAMES WHICH SHOULD BE REJECTED.

2. Specific names which are apt to excite ridicule should be rejected. Among such are:—

A. Those in which the trivial merely repeats the generic name, e. g. *Chloroxylon chloroxylon*, *Balsamita balsamita*, *Uva-ursi uva-ursi*.

B. Those in which the trivial is a mere variant of the generic name, e. g. *Silaus silaus*, *Sesbania sesban*, *Bambusa bambos*.

C. Those in which the trivial indicates that the species resemble the genus to which it is now assigned, e. g. *Cerastium cerastioides*, *Bauhinia bauhinioides*, *Fagræa fagræacea*, *Luzula luzulina*, *Bridelia brideliifolia*, *Licania licaniæflora*.

The names under 2 A are treated as "nomina rejicienda" in Art. 55. A liberal interpretation of this article would also exclude those under 2 B. As the Editor of this Journal (Journ. Bot. 1920, 276) has remarked, "*Sesbania sesban* comes dangerously near the duplication which has been generally condemned."

The consideration underlying Art. 55, 2°, was the desire to avoid names which are ridiculous in the eyes of the general public (Act. Congr. Bot. Vienne, 126; 1906). This applies with even greater force to those under 2 C. A "*Bauhinia*-like *Bauhinia*," and a "*Bridelia* with the leaves of a *Bridelia*" verge perilously on nonsense.

3. Seriously misleading geographical specific names should be rejected. This is in accordance with Art. 4 of the International Rules which enjoins the rejection of names which may cause error.

Examples:—*Hypericum mexicanum* L. does not occur in Mexico, but it is a native of Colombia, and the name *H. mutisianum* H. B. K. should be adopted for it (Triana et Planch. Prodr. 298). *Scilla peruviana* is a native of the Mediterranean Region, and the name should be replaced by *S. hemisphærica* Boiss.

Such names should, however, be rejected only in extreme cases: thus the numerous Chinese species which bear the trivial *japonicus* (E. H. Wilson, Nat. W. China, ii. 10; 1913) may be retained because they are cultivated in, and were originally introduced to, Europe from Japan. Similarly *Cephaëlis peruviana*, which is a native of Guayaquil in Ecuador, may be allowed to stand on the ground that Guayaquil was included in Peru at the time of Ruiz and Pavon, who collected the species.

4. Specific names which differ from previously published ones only in the adjective or genitive termination should be rejected. These were allowed under the International Rules, but it was recommended that they should be avoided in the future (Rec. IX.). It is more consistent to reject them as being names which may cause error or ambiguity (Art. 4). They are rejected under Canon 16 (c) of the American Code.

Examples:—*Lysimachia hemsleyi* Franch. should be rejected on account of the previously existing *L. hemsleyana* Maxim. It may be named *L. franchetii* R. Knuth. *Carex cavaleriensis* [sic] should be rejected on account of the earlier *Carex cavaleriei*. The employment of such pairs of names is bound to lead to confusion, especially in the case of cultivated species.

5. Accidental binomials occurring in works published since 1753, but which did not adopt the binary system of nomenclature consistently, should be rejected.

Examples:—Those contained in Garsault's works (1764–7), revived by Thellung in Bull. Herb. Boiss. sér. 2, viii. 713, 778 *et seq.*; those in Hill's *British Herbal* (1756), revived by Druce in Rep. Bot. Exch. Cl. Brit. Isles, 1913, iii. 436 (1914).

6. Specific names should be rejected when they are homonyms, irrespective of the validity of the earlier name. Under Art. 28 and 51 of the International Rules the validity of a specific homonym is dependent on the non-validity of the earlier name. As it may be a matter of opinion whether the earlier name is valid or not, the validity under these Articles of many homonyms will always be more or less doubtful. It is therefore desirable, in the interests of "fixity of nomenclature," that *all* specific homonyms should be rejected.

7. If a new combination is associated by its author in the original place of publication with specimens belonging to a different species, it should be treated as a "nomen delendum"; and the combination may be made *de novo*. If the original combination were treated as valid, it would become "a permanent source of confusion" (Art. 51, 4°).

Examples:—The new combination *Mærua nervosa* was applied by Oliver (Fl. Trop. Afr. i. 84; 1868) to a Zambesiland species which he erroneously identified with *Niebuhria nervosa* Hochst., a native of Natal. Gilg and Benedict have shown that the Zambesiland and Natal plants are not conspecific. They have re-named the former *Mærua cylindricarpa* Gilg et Benedict, and have proposed the combination *Mærua nervosa* (Hochst.) Gilg et Benedict for the latter (Engl. Jahrb. liii. 241, 244; 1915). Even if the name *Mærua nervosa* Oliv. is retained, it is uncertain to which species it should be applied; whether to the Zambesiland species on which Oliver's description was mainly based, or to *Niebuhria nervosa* Hochst. which he cited as a synonym and of which he retained the trivial. Botanists are not agreed as to the correct incidence of the name in such a case.

Schumann proposed the new combination *Dolichandrone atrovirens* expressly to replace *D. falcata* Seem. (Engl. et Prantl, Nat. Pflanzenfam. iv. 3 B, 240; 1894), being misled by C. B. Clarke's citation of *Bignonia atrovirens* Heyne as a synonym of the latter (Fl. Brit. Ind. iv. 380; 1884). But as I have elsewhere pointed out (Kew Bull. 1919, 307), *Bignonia atrovirens* is conspecific with *Dolichandrone crispa* Seem., and the combination *D. atrovirens* (Heyne) Sprague should accordingly be used in place of *D. crispa*. Schumann cannot be quoted as the authority, inasmuch as he applied the name to a different species.

Generic "nomina conservanda."

8. All generic names recommended in the future as "nomina conservanda" should be accompanied in each case by a summary of the generic history, and a statement of the reasons for and against the retention of the name.

The principle underlying the acceptance of "nomina conservanda" is of a common-sense nature: that there should be as little disturbance as possible in the present system of nomenclature. With this end in view, numerous well-known and much used names have been preserved in spite of the existence of prior names for the same genera. It seems to have been tacitly assumed by those who voted in favour of Art. 20 that all "nomina conservanda" should be valid in themselves, apart from the existence of prior names. Yet the generic name *Alsine* was proposed for retention at the Brussels Congress to denote a genus, *Minuartia*, which was not included in *Alsine* as originally published. *Alsine* Linn. (1753) was composed of *Stellaria* and *Spergularia*. It was not until 1762 that a species of *Minuartia* was added. Opinions may differ as to whether *Stellaria media* or *Spergularia segetalis* is the type of *Alsine* Linn. (see Britton in Bull. Torr. Bot. Cl. 1893, xx. 277; Sprague in Kew Bull. 1920, 316; Hiern in Journ. Bot. 1899, 317; Fernald in Rhodora, 1919, xxi. 7); but under no rules of nomenclature can the Linnean name be applied to *Minuartia*. Had the history of *Alsine* been carefully studied, this name would hardly have been proposed as a "nomen conservandum."

Orthography and Typography.

9. The genders of generic names should be determined in accordance with definite rules. Observance of this recommendation would remove a cause of offence to classical scholars, who complain with more or less reason of "grammatical blunders and false concords which disfigure botanical nomenclature" (Journ. Roy. Hort. Soc. xlv. 220).

A. The gender of a classical generic name should be retained, provided that the termination is either unchanged or merely latinized. Where the name occurs in both Greek and Latin, and the gender is different in the two languages, the Latin gender should be retained, Pliny's Natural History being taken as a standard. In the case of a new name formed from Greek or Latin words the classical gender of the final word should be retained, except in the case of compounds ending in -anthus (see 9 D).

Examples:—*Euonymus* should be masculine, although all the species are trees or shrubs. *Erigeron* should be masculine, although it was treated as neuter by Linnæus in Sp. Pl. ed. 1. *Didymocarpus* (ὁ καρπος) should be masculine, although generally treated as feminine. *Tragopogon* (ὁ πωγων) should be masculine, in spite of the fact that Linnæus regarded it as neuter. *Rhodochiton* (ὁ χιτων) should be masculine, not neuter. *Morus* is feminine. *Saprosma* (ἡ ὀσμη) should be feminine, although Blume treated it as neuter. *Diastema* (το στημα) should be neuter, although Bentham, who proposed the name, made it feminine. *Lissochilus* (το χειλος) should be neuter, although Robert Brown regarded it as masculine. *Polygala* (*το γαλα*) should be neuter, although it has has been treated as feminine until recently (Chodat in Engl. Jahrb. lii. Beibl. 115, 70; 1914). *Abroma* and *Theobroma* (*το βρωμα*) should be neuter, not feminine.

In order to show how inconsistent has been the allocation of genders to generic names, a few examples are taken from the *Index Kewensis*, which follows the general usage as regards gender.

Agathosma and *Coprosma* are treated as feminine, but *Xylosma* and *Saprosma* as neuter. *Dipterocarpus* and *Elæocarpus* are made masculine, but *Artocarpus* and *Didymocarpus* feminine. *Dianthus* and *Phyllanthus* are regarded as masculine, *Æschynanthus* and *Adenanthos* as feminine. *Sclerochiton* is given as masculine, *Brachychiton* and *Rhodochiton* as neuter. In most of these cases the gender given in the Index was the one used by the author of the genus.

B. When the termination of the final word of a compound is altered, the gender should follow it.

Examples:—*Cercocarpus* (m.), *Callicarpa* (f.), *Amphicarpæa* (f.), *Ormocarpum* (n.); *Ceratocephalus* (m.), *Dasycephala* (f.), *Dracocephalum* (n.), *Polycephalium* (n.); *Caryophyllus* (m.), *Aciphylla* (f.), *Bryophyllum* (n.); *Circæaster* (m.), *Cremastra* (f.), *Bellidiastrum* (n.).

C. Indeclinable names borrowed from non-classical languages should be treated as neuter.

Examples:—*Manihot*, *Taonabo*, *Amelanchier*, *Agati*, *Batatas*.

D. Compound names in which the final word is -anthos or -anthus should be masculine.

Examples:—*Adenanthos*, *Galanthus*, *Helianthus*, *Loranthus*, *Phyllanthus*. Strictly speaking, these should be neuter (*το ἀνθος*), but names of this kind are so numerous, and have been with such few exceptions treated as masculine, that it would be very inconvenient to change the accepted gender.

10. Orthographic corrections should be made in cases where the original spelling suggests a false etymology.

Examples:—The generic name *Anona* was derived from Anon, the Hispaniola name for *Anona squamosa*. It was first mentioned by Oviedo, Hist. lib. 8, cap. 18, as "Hanon" (1535); and in his second edition (1547) under the form "Anon" (Mart. Fl. Bras. xiii. pars 1, 14; 1841). Acosta, Hist. lib. 4, cap. 25, gave it the form *Anona*, which was generally accepted by subsequent authors until Linnæus (Hort. Cliff. 222; 1737) altered it to *Annona* (Lat., a year's produce), on the ground that *Anona* was a "barbarous" word. To some it might appear that it was the alteration of the spelling which was undesirable, as suggesting a false etymology. Jussieu (Gen. Pl. 283; 1789) restored the form *Anona*, which has been used until recently, and was accepted by Dalle Torre and Harms (Gen. Siphonog. 174; 1901). Safford (Journ. Wash. Acad. Sc. i. 118; 1911) and Fawcett and Rendle (Fl. Jamaica, iii. pt. 1, 194; 1914) have, however, adopted the spelling *Annona* used in Sp. Pl. ed. 1.

Trichodesma and *Pentadesma* (derived from *ἡ δεσμη*, bundle) should be written *Trichodesme* and *Pentadesme* (cf. *Sphenodesme*) in order to distinguish them from names like *Antidesma* (formed from το δεσμα, bond, chain). This spelling would indicate both derivation and gender.

Tetrapteris and *Heteropteris*, being based on πτερυξ, wing, not on πτερις, fern, should be written *Tetrapteryx* and *Heteropteryx* respectively (cf. *Dipteryx*).

A glance at Post and Kuntze's Lexicon (1904) is sufficient to demonstrate the need for caution in orthographic correction (Internat. Rules, Rec. XXX.). *Callicarpa* was disguised by these authors as *Calocarpus*, *Aciphylla* was changed to *Aciphyllæa*, and *Geissaspis* appeared as *Gissaspis*. And if *Aspicarpa* and *Ormocarpum* should be written *Aspicarpus* and *Ormocarpus*, surely *Pterocephalus* and *Dracocephalum* should be altered to *Pterocephala* and *Dracocephala* respectively, and *Cryptocarya* should become *Cryptocaryum*. And in any case the correct forms would be *Aspidocarpus*, which happens to be preoccupied, and *Dracontocephala*. To such alterations there would be no end.

Correction appears desirable, however, in such cases as the following:—*Epipogum* should be *Epipogon*, as the Latin termination -um corresponds to the Greek -ον, not to -ων. *Ranunculus acris* should be corrected to *R. acer* (adopted by many continental botanists); and *Chærophyllum temulum* replaced by *C. temulentum*. The latter form was used by Linnæus himself in Fl. Suec. ed. 2, 94 (1755).

11. All trivials should be spelt with a small initial letter. The International Rules recommend (Rec. X.) a capital where the trivial is formed from the name of a person, or is an old generic name, but a considerable expenditure of time is often entailed in ascertaining whether a given name comes under either of these categories. There has been, and still is, so much diversity of usage in regard to a capital initial letter that it is often necessary to investigate the early history of a species in order to decide whether the trivial should be spelt with a capital or not.

A small initial letter is used for all trivials in the following works:—Hemsley, Bot. "Challenger" and Biol. Centr.-Amer., Bot.; Contrib. U.S. Nat. Herb.; Philipp. Journ. Sc.; Jepson, Fl. W. Middle Calif.; and Stapf, Fl. Liberia (in Johnston *Liberia*, ii. 570–669).

12. The comma between the name and the authority should be omitted. It is omitted in the International Rules, and in a great majority of current botanical periodicals.

The reasons for the preceding suggestions may be summarized as follows:—

No. 1 revokes Art. 36, which is not in accordance with the general principles on which the International Rules were explicitly based. Art. 3 states that the rules of nomenclature must be founded on considerations clear and forcible enough for everyone to comprehend and be disposed to accept. But Art. 36 is highly controversial, and was passed by a relatively small majority.

Nos. 2, 3 and 9 reject names or forms of names which tend to cast ridicule on systematic botany.

Nos. 3, 4, 6 and 7 reject names which are liable to lead to confusion or error.

No. 5 definitely rejects numerous names whose validity under the International Rules is very doubtful, and which are in any case superfluous.

If No. 8 were adopted, lists of nomina conservanda would command more respect; at present they are apt to be regarded as arbitrary.

The acceptance of No. 11 would lead to a great saving of time.

Finally, the adoption of Nos. 1 and 6 would prepare the way for that world-wide agreement on plant nomenclature which must be the aim of all who have the progress of systematic botany at heart.

[We shall be glad to publish comments on Mr. Sprague's paper, or to publish further suggestions. With regard to no. 11, the paucity of examples of the use of a small initial letter for proper names may be noted, as also the fact that the practice, temporarily adopted at Kew, has since been abandoned there.—Ed. Journ. Bot.]

POTAMOGETON IN THE ENGLISH LAKES.

By W. H. Pearsall and W. H. Pearsall, M.Sc., F.L.S.

In examining the aquatic vegetation of the English Lakes, the authors have been much struck by the great variability shown by the genus *Potamogeton*. In many cases, the species observed in nature showed an obvious relation to the environmental conditions under which they grew, and it was often a matter of some difficulty to decide whether the differences observed in the various species were simply form variations due to the environmental conditions, or distinct characters having no necessary relation to the environment. In the former case, alteration of the environmental conditions toward the normal would be followed by modification of the characters of the plant under observation, giving it a more typical form. In the second case—on the other hand—the variations observed would not be lost on alteration of the habitat conditions.

In addition to the consideration of such cases of observed variation, it is proposed to enumerate the species of *Potamogeton* found in the English Lake District, and to summarize their distribution.

The *pusillus* section of the genus *Potamogeton* is divided by Hagström in his "Critical Researches on the Potamogetons" (Kungl. Svenska Vetenskapsakademiens Handl. Bd. 55, 1916) into the two groups:—

I. Pusilli connati: *P. rutilus*, *P. mucronatus*, and *P. panormitanus*.

II. Pusilli convoluti: *P. obtusifolius*, *P. Sturrockii*, *P. pusillus*, and *P. franconicus*.

Of these species, *P. rutilus*, *P. mucronatus*, *P. Sturrockii*, and *P. franconicus* have not been yet found in this district, although occurring in other parts of Britain.

Potamogeton panormitanus Bivona Bernardi. Nuove piante inedite, Palermo, 1838, 6–7. *P. gracilis* Fries, Novit. Fl. Suec. 1828, 50. *P. Noltei* Ar. Benn. in Journ. Bot. 1890, 300.

This species has long been confused with *P. pusillus* or treated as a variety of it. It differs from it, however, in many essential features. *P. pusillus* under favourable conditions produces copious distichous branches in the upper part, assuming a bush-like habit, but the branching of *P. panormitanus* is mainly from the base, and any necessary prolongation is attained by the lengthening of the upper internodes rather than by multiplication of branches. The spike-bearing branches of *P. pusillus* are relatively long, those of *P. panormitanus* short. The leaves of the former are darker in colour—dull green or brownish—softer in texture and normally with a sub-obtuse apex. Those of the latter are lighter (or yellowish) green, much stiffer, with a more prominent midrib (which, however, lacks the characteristic 1 or 2 rows of lacunæ of *pusillus*) and a longer, more acute apex. Even more diagnostic are the stipules and turios. In *P. pusillus* the stipules (ligules of Hagström) are always open and convolute, but in *P. panormitanus* they are connate for quite two-thirds to three-fourths of their length. The turios of the former are larger, more swollen in the middle, and developed best in the branch-tops, while those of the latter are smaller (12–15 mm.), more slender and produced at the base of the stem or branches. Hagström (p. 102) says "very rarely there are turios on the rhizomes." We have seen them in that position on Lake District specimens of this species, but never thus in *P. pusillus*. *P. panormitanus* flourishes here only in Esthwaite Lake on the finest and richest soils—whereas *pusillus* and *lacustris* are rather more cosmopolitan in in this respect—under a light-intensity of 10 % or less, and these conditions may possibly be universal.

Of herbarium specimens we have seen, many of those labelled *P. pusillus* or *P. trichoides*, and all those under *P. pusillus* var. *tenuissimus* are this species.

P. panormitanus does not appear to vary much under the different light conditions in which it has been found. In this respect it differs markedly from *P. obtusifolius* and *P. pusillus*.

P. OBTUSIFOLIUS Mertens et Koch in Röhling *Deutschlands Flora*, 855 (1823); Cham. et Schl. in *Linnæa*, ii. 178 (1827); Fries, Novit. Flor. Suec. ed. 2, 47 (1828); Koch, Syn. Fl. Germ. et Helv. ed. 2, ii. 780 (1844); Reichenbach, Icon. Flor. Germ. vii. 16 (1845); Syme, Eng. Bot. ed. 3, ix. 47 (1869); Hooker, Stud. Fl. ed. 3, 435 (1884); Bab. Man. ed. 9, 442 (1904); Morong, Naiad. N. Amer. 40 (1893); Asch. et Graebn. Synop. Flor. Mitteleur. ed. 2, 521 (1913). *P. gramineus* Smith, Eng. Fl. ed. 2, i. 235 (1828). *P. compressus* Roth, Tent. Fl. Germ. i. 73 (1788).

Stem normally much branched, slender, compressed. Leaves sessile, narrowed below, very slightly tapering at the apex, obtuse or rarely subacute, mucronate. Usually 3-nerved, but we have leaves from ponds on Colthouse Heights with 5 nerves; Syme (*l. c.*) says he has never seen such; Koch gives 3–5, while Fieber, Pot. Böhm. 1838, figures 7. Length variable, about 7·5 cm. × 2 mm. in Esthwaite, but showing the same tendency as *P. pusillus* to elongation in deep water. Stipules open, very obtuse, unequal in length, about 15–20 mm. Peduncles very short as a rule—about 8 mm.—but in Hawes Water, Silverdale, 36 mm. Fruits normally larger (3·0–

3·5 mm.) than in *pusillus* or *mucronatus* (*Friesii*), but occasionally only 2·5 mm. long and then similar to those of *pusillus*. Fruiting more freely than any other linear-leaved species and in Esthwaite readily propagating by large winter-buds also. It is the only species of *Potamogeton* in this district frequently producing fertile fruit under water. This species occurs in Windermere, Esthwaite, Hawes Water, and Grasmere, upon more fertile soils than either *pusillus* or *lacustris*. In Esthwaite and Hawes Water it is found under a light-intensity of 10 % or less.

Potamogeton pusillus L. Sp. Pl. 127 (1753); Fries, Novit. Flor. Suec. ed. 2, 48 (1828); Fieber, Pot. Böhm. 39 (1838); Koch, Synop. Fl. Germ. et Helv. ed. 2, ii. 780 (1844); Syme, Eng. Bot. ed. 3, ix. 49, tab. 1419 (1869); Hooker, Stud. Fl. ed. 3, 435 (1884); Morong, Naiad. N. Amer. 45 (1893); Bab. Man. ed. 9, 442 (1904); Asch. et Graebn. Synop. Fl. Mitteleur. ed. 2, 525 (1913).

Stem nearly cylindrical, very slightly compressed; often much branched in the upper part, at times nearly simple. Leaves narrowly linear, very variable in length with a marked tendency to elongation in deeper water.

(*a*) Deep-water forms with long and narrow leaves about 50–70 mm. × 0·8–1·0 mm., narrowed below and gradually tapering to an acute tip (*cf.* Crummock).

(*b*) Intermediate forms (typical) with leaves normally about 30–45 mm. × 1·0 mm., with tips more or less rounded and sub-acute. (Pond form, *cf.* Mouzell, Green Haulme.)

(*c*) Shallow-water and high light-intensity forms with short obtuse leaves less than 30 mm. long and 1·4–1·8 mm. broad; darker and thicker in texture than (*a*) or (*b*) (*cf.* High Dam).

All submerged leaves soft and flexible, obtuse, sub-obtuse or acute, 3-nerved with 1 or 2 rows of lacunæ on either side the midrib. Lateral nerves very near the margin. Ligules small, obtuse, always open and convolute. Peduncles slender, very variable in length. Fruit small (2·0–2·5 mm.), not smooth, normally broad below.

This species is found in the English lakes upon the coarser and only moderately fertile soils (cf. *lacustris*) under a light-intensity of 90 – 8 %. The two types—*pusillus* and *lacustris*—remain distinct where their light-intensity conditions overlap, as in Crummock.

The leaves vary in colour from light green to dull olive-green. In Klingksieck and Valette's *Code des Couleurs* (Paris, 1908) these colours are numbered respectively 282 and 238—as viewed against white paper. In older leaves the colour may be tinged with brown (No. 232, K. & V.). The colour of *P. panormitanus* varies between Nos. 276–278 (K. & V.).

Normally the leaves are between 20–40 mm. in length, and rarely over 1 mm. in width. The extreme length that has been observed is 70 mm. (Crummock W.), and the extreme width 1·8 mm. (High Dam). A characteristic feature of the leaves is that they gradually taper toward the apex and are narrowed below—very long leaves appearing subpetiolate. The involucral leaves have very prominent air lacunæ and are considered to represent primitive floating leaves.

As shown above, *P. pusillus* exhibits distinct variations in relation to the depth of water in which it grows, and since most of these variations—if not all—have been reproduced experimentally by growing the plant under varying light-intensities, it may be assumed that light-intensity is the chief factor in causing them. In deep water and low light-intensity the leaves are long, acute, and of a clear translucent green (No. 282, K. & V.). In shallow water they are much shorter, more obtuse, and of a dull olive colour (No. 238, K. & V.).

A comparison of two lots of material grown in water of the same transparency and on similar soil gives :—

	1. Typical *pond* type.	2. Deep water *lake* type.
Depth in feet	3	12
Light intensity %	35	7 to 8
Average leaf length *...............	30·7 mm.	45·4 mm.
Average leaf breadth *	1·0 mm.	0·9 mm.
Colour of leaves (K. & V.)	238	282

Subsp. LACUSTRIS (nobis). *P. Sturrockii* Ar. Benn. Rep. B. E. C. 841 (1919); nec Pots. Brit. Is. 85 (1915), nec Scott. Nat. 28 (1883), nec *P. pusillus* L. subsp. *Sturrockii* Hooker, Stud. Fl. ed. 3, 435 (1884).

Folia omnia submersa linearia, basi attenuata, apice rotundata, trinervia, ca. 30–50 mm. longa, 1·3–2·0 mm. lata. Ligulæ fissæ convolutæ. Pedunculi breves ± 24 mm. Spica 2–3 mm. Fructus non visus. Anatomia ut in *P. pusillo.*

This beautiful and characteristic deep-water derivative of *P. pusillus* occurs in all of the larger English lakes, and is, in our opinion, quite distinct from any other form of that species and from *P. Sturrockii* Ar. Benn. (*P. panormitanus* × *obtusifolius*). It shows no signs of either of the latter species in its ligules or anatomy, and, moreover, *P. panormitanus* occurs only in Esthwaite, and *P. obtusifolius* only in Windermere, Esthwaite, and Grasmere. It differs from all other forms of *P. pusillus* in its much broader leaves of uniformly lighter colour, No. 277 (K. &V.), with apices very obtuse—usually nearly semicircular—and in the fact that it propagates itself solely by means of winter-buds. It is not *P. pusillus* (type), for this assumes shorter and broader leaves having thicker texture and darker pigments, in shallow water, and in deep water very long and narrow leaves gradually tapering into an acute tip. Moreover, culture under weak light-intensity (5 % or less) does not change the type *pusillus* into *lacustris,* but only into the deep-water form as found in Crummock. Finally, *lacustris* shows but slight variations in relation to depth and light-intensity, and it is not known from calcareous waters, whereas *pusillus* affects both calcareous and siliceous types of water.

On the other hand—anatomically and superficially *lacustris* is a *pusillus* derivative, and in accordance with this its first-formed leaves are of the *pusillus* type in most essentials. We therefore regard it as a subspecies—*P. pusillus* L. subsp. *lacustris* (nob.).

* Averages of fifty leaves.

Stem terete, thread-like, branched, with internodes and anatomy as in *P. pusillus*. Leaves of thin texture, soft, light green in colour—reddish or brown in older leaves—pellucid, 3-nerved with lacunæ on either side of the midrib and lateral nerves near the margin, slightly narrowed below, not tapering above, apex very rounded-obtuse—usually more so than in *P. obtusifolius*. Ligules open and convolute. Peduncles slender, short, ± 24 mm., with small few-flowered spikes (2–3 mm.)—only seen once (Esthwaite) during an abnormally hot summer. Mature fruit not produced; propagating by winter-buds. Occurs in Windermere, Coniston, Esthwaite, Derwentwater, Bassenthwaite, Ullswater, Crummock, Buttermere, Ennerdale, Wastwater, and Hawes Water, upon finer and more fertile soils than *P. pusillus* and under a light-intensity of 10 – 2 %, at depths varying from 5–8 ft. (Esthwaite) to 20 ft. in lakes with clearer water (Ullswater). Of the stations recorded in this preliminary paper, those in Wastwater, Ennerdale, Crummock, Buttermere, and Derwentwater are in Cumberland, v.c. 70; Hawes Water is in Westmoreland, v.c. 69 *a*; Windermere, Coniston, and Esthwaite Water are in N. Lancs., v.c. 69 *b*; and Hawes Water, Silverdale, in W. Lancs., v.c. 60. Stations in Ullswater are in both 69 *a* and 70. All other waters cited are in N. Lancs.

(To be continued.)

THE LICHEN LIFE-CYCLE.

By A. H. Church.

(Continued from p. 145.)

III. The Lichen.

The more generalized scheme of Ascomycete progression is considerably amplified by the story of the Lichen. In spite of intrusive algal protoplasts now exploited as a convenient source of carbohydrate, the thallus is still little more than that of a skinned sea-weed with no superficial tissue of an older order as photosynthetic ramalia or cortex, or even superficial reproductive ramuli; however much the growth-form and ramification of older marine somata may continue in operation with the new investment of algal 'gonidia' (cf. *Cladonia*, *Ramalina*, *Usnea*, *Dactylina*). In many cases the reproductive mechanism is much more definite. The antheridial ramuli are abstricted in minute conidial form, as so-called 'spermatia.' Algal zoïdogamy is replaced by spermatogamy [1], instead of by the siphonogamic approximation suggested by *Pyronema* and *Sphærotheca*. Cross-fertilization may be still procurable in an open medium: water-carriage of the minute spermatia remains predominant; air-carriage is doubtful and wholly unproven. The reproductive ramulus of the megagamelangium is not at all oogonium-like where known (*Collema*, *Physcia*, *Usnea*), but ends in a uniseriate ramulus of cell-organization quite distinct from that of the

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[1] 'Spermatogamy' as applied to the method of conjugation in the Florideæ, in which such phenomena were first clearly described by Bornet and Thuret (1867). The word is open to the objection that it is too suggestive of Seed Plants (Spermatophyta), and of fertilization by a 'sperm'; but with its present suffix it is the only readily intelligible correlative of zoidogamy and siphonogamy.

normal mycelium; to such an extent, in fact, that it has been mistakenly associated with the spermatogamic mechanism of the Florideæ of the sea, though wholly different from the latter in construction and cytology, so far as is known, in the relatively few types for which it has been at all completely described[1]. There can be no doubt that the organization of these carpogonial ramuli, in terms of uninucleate cell-segments of a uniseriate filament with primary pit-connections, actually reproduces *the original cell-mechanism of the algal prototype*, and is thus entitled to receive much more detailed consideration[2]. To place two such divergent types of reproductive mechanism, one siphonogamic, the other spermatogamic, as two divergent variants on the original mechanism of zoïdogamy, in the same family of Ascomycetous Fungi, may be open to objection; but too little is known of the various types to draw the line sharply (cf. *Polystigma*, *Lachnea*, *Xylaria*). For present purposes the point to indicate is that spermatogamy, however vague for the Ascomycetes as a whole, is undoubtedly the dominant method for Lichen-fungi[3], as it is also a biological process for securing cross-fertilization, and is undoubtedly of strictly marine origin. Further, although an autogamous and decadent condition of spermatogamy might end in siphonogamic approximation, there is much less evidence that spermatogamy could be evolved *via* siphonogamy. To this extent the condition of spermatogamy appears to lie behind the whole of the series; at the present stage it suffices to introduce the fact that it is generally accepted as primitive for Lichen-fungi. A very similar mechanism of fertilization is still operative through the entire series of the Rhodophyceæ; and if the Lichen-gametophyte presents phenomena of spermatogamy, it undoubtedly inherits this mechanism also from marine ancestors.

On the other hand, the presumably diploid sporophyte follows identically the ascogenous habit. This phase, already predominantly holoparasitic, takes no part in the new association with algæ; though algal intrusion even among the asci may obtain in some special cases (as a secondary association in connection with dispersal-function rather than of nutrition—*Endocarpon*). Identical phenomena of apothecial hymenial tracts, scattered on the branches of an algal frond-system, reduced to few, or to scattered discs on disc-types of soma, or again presenting the case of immersed perithecia, all follow the normal Ascomycete progression, with a degree of parallelism which undoubtedly indicates that this stage of the life-cycle was equally firmly established before any Lichen-habit had been begun. As in the typical Ascomycetous Fungi, the stage of asexual sporangial reproduction enables one to visualize a still older phase of algal construction, before the elaboration of heterogamous ramuli, when the asexual sporangium was, in fact, but the apogamous modification of the unilocular gametangium emitting flagellated zoïds in the manner of the hymenium of *Aglaozonia* and *Zanardinia*, or even of the more remote horizons of *Laminaria* and *Chorda*.

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[1] Baur (1904) Bot. Zeit., *Collema* p. 23, *Anaptychia* fig. 10, *Cladonia* fig. 40.

Darbishire (1900) Prings. Jahrb., t. xi. fig. 3, *Physcia*.

Nienburg (1908) Flora, *Usnea* t. 1, fig. 5.

[2] The spiral coiling is clearly the expression of intercalary extension, and the effect of an outthrust to the exterior, as in the case of the kink in the hair-trichogyne of the Florideæ. The essential feature of the cell-units is their isodiametric character; the primary pit is emphasized, but a similar pit indicating an older soma on the Floridean model, is characteristic of the *hyphæ* of all higher Fungi (Wahrlich, 1892; Meyer, Bot. Zeit., 1902).

[3] Even in cases where no spermatia have been found; cf. *Solorina*, *Peltigera*, *Peltidea*, *Nephromium*.

It is only in this way that a clear conception of the Lichen-history can be approached, *via* a recognition of the mechanisms of reproduction initiated in the sea, and following the progression of what has been termed the 'Benthic Phase.' With the aid of modern sea-weeds (as in Phæophyceæ and Florideæ) it is possible to go back step by step in the interpretation of the factors to which the special case of the Lichen-fungus is the response, and to travel up through all the horizons of marine progression to the problems of the sub-aerial transmigration. Thus behind the heterotrophic somata of these varied forms, one discerns the primary characters of the older autotrophic soma in the details of the more conservative reproductive ramuli; just as in the massive parenchymatous soma of *Fucus*, the reproductive ramalia maintain the older filamentous organization, or the distinctive procarpial ramuli of the Florideæ with their associated assimilatory filaments may now be found wholly immersed and buried within the felted texture of the smooth lamina of *Dilsea edulis*. Similarly, while the differentiated sexual ramuli must have passed through stages of heterogamous progression before they attained their present condition of fertilization *in situ*, it is to the hymenium of the asexual generation that one looks for the oldest type of reproductive organ of the group—a simple unilocular structure of the distant horizon even beyond the meiotic gametangium of *Fucus*.

Having indicated the phyletic connection of the Lichen-fungi with the modern saprophytic and parasitic Ascomycetes of the land, in favour of the priority of the former, it remains to compare them with the only living group of marine algæ with which they present certain features in common. Ever since the time of Sachs (1874) [1], land-botanists have persistently associated Lichen-fungi, and hence Ascomycetes as a whole, with the great and supremely isolated group of beautiful marine vegetation known as the Florideæ. The point is, again, to what extent is the agreement real and phyletic, or merely an approximation in similar biological features of adaptation (*homoplasy*) in wholly distinct algal series of the past. Also, what is more important—To what extent may such parallelism afford a revelation of a common response to similar conditions of environment in the sea?

IV. THE STORY OF THE FLORIDEÆ.

This is sufficiently well-known to admit of detailed comparison, and the discrepancies are at once obvious. The Life-cycle of a typical Floridean is expressed in *three* phases, rather than two.

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[1] Sachs (1874) Textbook, Eng. Trans., 1882, p. 284, Carposporeæ.
Strasburger (1912, Eng. Trans.) pp. 387–389, much emphasized.
Thaxter (1896) Monograph of Laboulbeniaceæ, p. 254, "mere speculation."

Types formerly accepted as elementary, with a two-phase cycle (*Nemalion, Scinaia*)[1], are now clearly recognized as examples of deterioration following a state of autogamy, in which the loss of a tetrasporic individual is associated with causal or consequent secondary localization of meiosis at the germination of the zygote. The gametophyte individuals attain fertilization *in situ*, with a resultant holoparasitic sporophyte-generation, which, it is true, is nourished, protected, and even its spore-output controlled by cystocarpic and ostiolar mechanism; but it does not produce a hymenial layer of sporangia and paraphyses, nor even of meiotic sporangia. The entire uninucleate content of each end-ramulus of the cystocarpic plant (*carposporophyte*) is discharged as a single monospore (*carpospore*); and it takes a third generation (*tetrasporophyte*) to provide the meiotic tetrads. The meiotic unilocular sporangium thus produced has equally constantly one meiotic tetrad with no further mitotic divisions, and so far presents a stage clearly one degree more limited than the normal ascus with its set of eight ascospores. In three fundamental respects, which all appear as stages of progression respectively more advanced than those of modern Ascomycetes, the latter present indications of an algal organization older than that of the modern Florideæ, and one of theoretically greater simplicity; nearer, that is to say, the horizon of such a form as *Cutleria*.

On the other hand, biological parallelism in the mechanism of fertilization is at first sight very close; and it is to this that attention has been directed more particularly by advocates of the primary value of sexual relations. The details of Floridean genera indicate with great unanimity a differentiation of 'spermatia,' as the contents of the antheridium are discharged in a uninucleate condition, 'in endochiton' in the manner of monospores[2]—*i. e.* still surrounded by the lining-layer of the mother-cell—a method wholly distinct from the abstriction of the conidial spermatia of Lichens[3]. The carpogonium of the Florideæ is extraordinarily constant as a residual minimum ramulus of an older filamentous type of soma, commonly represented by a pedicel-region of three cells, with a terminal 'carpogonium' extended as a mucilage-hair 'trichogyne,' and furnished with two nuclei, only one of which is employed as the female gamete. Fertilization follows spermatogamic conjugation, and the diploid zygote-nucleus, in the more progressive types, is left implanted in the plasma of an 'auxiliary' feeding-cell which initiates the next generation. But here, again, there is no homology with the corresponding ramuli of the Lichen-procarp and its uniseriate row of cells as so-called 'trichogyne.' The physiological mechanism is analogous, but the details are clearly not homologous; *i. e.*, the mechanism is devoted to the same end, the general scheme of operation is much the same, and the resultant effect is much the same; but the details of the corresponding mechanism belong clearly to two quite

[1] Kylin (1916) Berichte, 34, p. 257: Cleland (1919) Annals Bot., p. 323.

[2] Guignard (1889) Revue Gén. Bot., p. 175.

[3] Yamanouchi (1906) Bot. Gaz. 42, p. 411, describes the spermatium of *Polysiphonia* as directly abstricted, and the Lichen-type may be equally derivative.

distinct categories of algal construction. Both, in fact, represent a device for the fertilization *in situ* of an oogonium more or less immersed in the parental soma, instead of being freely exposed at the surface. The agreement is in biological factors rather than in structural details. What does emerge is the fact that such parallelism of response, as expressed in the inception of spermatogamy, must have been the consequence of the action of identical environmental conditions; and that, so far, the Lichen-fungus must trace its origin to the same environment as that which has produced the modern Floridean; that is to say, to the formation of reef-pools in the warmer seas. Further interpretations will be bound up with the story of the progression of the Florideæ from the undoubted original method of sexual reproduction in terms of flagellated gametes, now so hopelessly lost, and difficult to trace. The complete history of the Florideæ is hence to be analysed by comparison with other existing phyla of the sea which retain their flagellated phases, and the secondary nature of their specialization has to be accounted for. In doing this, one may hope to throw light upon the causes which similarly induced the analogous mechanism of Lichen-fungi.

That two such groups of Algæ as 'Brown' and 'Red' sea-weeds should co-exist, apparently side by side in all the varied biological stations of the sea, and yet be so remotely allied in somatic and reproductive organization, is one of the most interesting botanical problems of the sea. Since such wide divergence must be based on some factor of fundamental significance in their respective vital complexes, however, it may elude observation at first sight. Nothing could more definitely illustrate the vast number of other marine races with intermediate, older, or even more special characteristics, that must have existed and disappeared, than such extreme divergence of these two great residual phyla of modern seas, in which Green Algæ play but a minor part. Any light that can be thrown on the organization of such old races, or may now be seen in the fate of their much modified migrants of the land, should be welcome; and there can be little doubt that in Ascomycetes, Lichen-fungi, and Laboulbeniaceæ, may be traced such suggestions of Pre-Floridean or Para-Phæophycean phyla. Without going into minute detail, the differentiating characteristics of the existing types may be summarized by saying that the Brown Algæ are highly organized somatically, in virtue of a true parenchymatous mode of cell-construction, and they still dominate the optimum stations of the sea, with less insistent demands on their capacity to make good the wastage of their reproductive cells, which hence remain in a comparatively elementary grade of specialization. Red Sea-weeds, on the other hand, are somatically of very inferior filamentous organization, never truly parenchymatous, and presenting an entirely different order of metabolism in their individual protoplasts, in virtue of which they are relegated to more secondary positions in the biological provinces of the sea. They become characteristic denizens of quieter water and more shaded situations, as plant-forms of mediocre size, but with wastage-problems intensified, and consequent extreme specialization of their reproductive organization to the limit of economy of which the vegetation of the sea is capable. Economy of the wastage of gametes thus passes far beyond the mere heterogamy of the Phæophyceæ, so admirably illustrated by the highest Fucoids of the Brown alliance (*Sargassum*, *Himanthalia*), to fertilization *in situ*, and all following stages of post-sexual nutrition of the zygote—to a condition, in fact, almost comparable with that of the Angiospermous Flowering-plant, in which the gametes are now reduced to the state of mere undifferentiated nuclei. The latter, again, are produced in the Florideæ within reproductive organs also with a minimum of differentiation. In fact, the procarpial mechanism of the Florideæ is readily identified in practice, not by looking for the actual carpogonium, but for the characteristic vestigial ramulus of an older uniseriate filamentous construction which remains as gametophore.

The point of departure for all this progression is evidently to be found in the institution of spermatogamy, as replacing the zoïdogamy of older flagellated races, still retained dominant in the Phæophyceæ. The immature antheridial ramulus, or its uninucleate contents, is precociously discharged in the manner of the emission of the antheridium of *Fucus*, and the mucilaginous distal end of the oogonial hair-termination becomes a receptive 'trichogyne'-apex with which conjugation may be readily effected. By such fertilization *in situ* all wastage of fertilized oospheres is eliminated, and cheap minimum units conveying the male gamete-nucleus are produced in a quantity, sufficient in a gently moving medium, even without the differentiation of motor-flagella, to be fully effective in promoting fertilization, provided a satisfactory plankton-rate be attained. This last factor affords the clue to the situation. Flagellar activity, the inheritance of a bygone plankton-phase and its photosynthetic problems, and apparently never effective to a rate of more than a foot per hour, is clearly of little value as the main mechanism of sexual approximation in rough surface-waters on a rocky shore. The flagella of the zoïds of such a reef-pool form as *Dictyota* are already clearly deteriorated. Complete loss of all such flagellation will be equally disadvantageous in dead still water; though the latter condition is probably never attained in the sea, and even in the quietest sunlit pond there will be convection-currents in operation sufficient to move minute reproductive units of density practically similar to that of the medium. The quiet pool becomes the limit of aqueous environment, whether in tide-pool formation, or on tropical coral-reefs, where an oceanic tide may be negligible. This is the habitat which has produced the very precise type of fertilization in the Florideæ, however much stray members of the group may survive in subsidiary stations, even in Arctic seas (*Phycodrys*), or be relegated to deep quiet levels; and it begins to be clear that all other spermatogamic races must have passed through the same environment, wherever they may be found established in the present world. Similar phenomena of spermatogamy thus tracing their inception to the pool-formations of the sea-margin, in which a sufficient plankton-rate may be attained within the possibilities of the dilution of a comparatively small volume of water at little expense,—the average plankton-rate of a preceding plankton-phase being visualized as representing a million units to a litre [1],—are presented in three at first sight widely different and divergent plant-series of the present world. Of these the Florideæ still remain a wholly marine group, with but the slightest transmigrant extensions to fresh-water streams of the land (*Batrachospermum*, *Lemanea*); Lichens, as plant-forms capable of enduring the most extreme conditions of exposure and desiccation, in association with their algal helots; and thirdly the equally marvellous race of the Laboulbeniaceæ, holoparasitic on insects of the water and of the land. In tracing the connection of this last group of at present wholly isolated fungus-types with their marine ancestors, one may possibly find a further clue to the methods by which such subaerial forms have been enabled to pass the period of the transmigration.

(To be continued.)

THE MARITIME FORMS OF MATRICARIA INODORA.

By L. V. Lester-Garland, M.A., F.L.S.

It seems worth while to attempt to give an account of the present state of our knowledge of the various maritime forms of *Matricaria inodora*. There is a considerable number of them, and they present a great range of variation, but the extreme forms are connected by intermediates. It is hard to know what to do with such a series. The variety may be the result of inter-crossing, or there may be a number of "pure" races which we have so far failed to discriminate. A complete account of them is impossible without a prolonged study of the plants themselves in a living state, of their environment, and of their response to changes of environment.

These forms all agree in presenting certain definite points of difference (though not of *structural* difference) from the agrestal *M. inodora*. (*a*) They are biennial or perennial, not annual. (*b*) They are more robust in habit. (*c*) They are more or less fleshy or succulent. There are also certain features which are not common to all of them, but which appear in one or more of them, but not in *M. inodora*. (*a*) The fruit is larger and more fleshy. (*b*) The flowers are often larger and the ray-florets in some cases broader. (*c*) The margin of the phyllaries often has a brown border—light or dark, narrow or deep.

The question then arises whether it is best (1) to include them all under some specific name, e. g. *M. maritima*, as distinct from *M. inodora*; or (2) to rank certain of them as varieties of *M. inodora* (as is done by some botanists in the case of var. *salina*), and regard the rest as specifically distinct; or (3) to regard them all as varieties or forms of *M. inodora*. On the whole, the last course seems to me to represent the facts most closely, and I suggest that the forms may conveniently be grouped under three heads.

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[1] 'Plankton-phase and Plankton-rate,' Journ. Bot. 1919, Supp. iii.

1. Var. MARITIMA (L.).

Matricaria maritima L. Sp. Pl. ed. ii. 1256 (1763).

Chamæmelum inodorum a. maritimum Reichb. Ic. Fl. Germ. xvi. 47 & t. 94, f. iii.

Linnæus's short diagnosis is as follows:—"Matricaria receptaculis hemisphæricis, foliis bipinnatis subcarnosis: supra convexis, subtus carinatis": the habitat is given as "in Europæ septentrionalis littoribus maris." Little help is to be derived from the specimen preserved in the Linnean herbarium, which consists of the end of a shoot and has been damaged by insects. There is, however, one point in his description which can perhaps be relied upon to separate his plant from other maritime forms of *M. inodora*, and that is the hemispherical receptacle: in *M. salina* the receptacle is consistently described by various authors as conical or as resembling that of the type. It is also to be noticed that Linnæus localises his plant as from the northern coasts of Europe. It is true that this might only imply that he had not seen it from further south, and that "*salina*" extends at all events up to parts of the northern coasts of Europe; but there is a form which answers to Linnæus's brief diagnosis and which certainly does not extend nearly so far south as *salina*, and this appears to be sufficient to justify the use of his name for it. In this form the segments of the leaves are distant, not close-set as in *salina*, and the leaves themselves form a wider angle with the stem. The branches also are less erect, often leaving the stem almost at a right angle, which produces the "diffuse" look mentioned by several writers. The capitulum is more fleshy, and the top of the peduncle much thickened at maturity. The leaf-segments are longer than in typical *salina*, and may be more or less flattened or subfiliform (f. *angustiloba* Rouy, Fl. de Fr., *Tripleurospermum maritimum* Koch Syn. ed. 2 in add. p. 1026). The colour of the edges of the phyllaries varies as in *salina*, but they are never so broad or so black as in *phæocephala*.

2. Var. SALINA DC. Prodr. vi. 52 (1837); Bab. Man. ed. vi. (1867).

Pyrethrum inodorum β. salinum Wallr. Sched. Crit. 485 (1822).

Chrysanthemum inodorum L. *β. maritimum* Lloyd, Fl. de l'Ouest, ed. 4 (1886) p. 192.

"*Matricaria maritima* L." Corb. Nouv. Fl. de Norm. 324 (1893).

Chamæmelum inodorum β. salinum Reichb. Ic. Fl. Germ. xvi. p. 47 & t. 94. f. ii.

Chamæmelum maritimum Willk. Prodr. ii. 93 (1870) *fide* Lange in Suppl. p. 83.

Wallroth's description is as follows:—"Pinnis foliolorum linearibus confertissimis brevibus mucronatis subtus parce pilosis, petiolorum approximatis pectiniformibus caulem decumbentem purpureum ambeuntibus." He goes on to say that he sees no reason to regard the plant as anything but a variety of *Pyrethrum inodorum*, distinguished by the shorter and closer-set pinnules of the leaves which are crowded round the stem "pectinis instar" and the stouter, decumbent, always bright purple stem, but that it is (specifically) distinct from *P. maritimum* Sm. De Candolle accepted Wallroth's description, simply transferring the plant to the genus *Matricaria*. Rouy, Fl. de Fr. viii. 257, is therefore right in quoting him as the authority. Babington's later var. *salina* clearly refers to the same form, which is common and easily recognizable: it may be doubted whether he meant to establish a new variety.

The essential feature of the variety is found in the close-set leaf-divisions. The leaves are generally erect, not wide-spreading, and so lie more or less close to the stem, and the same thing is true, broadly speaking, of the flowering branches. As a rule the lobes are short, but there are plants with elongated lobes which are best put under this variety. The purple colour—fainter or deeper—is very general, as are the decumbent stems, but plants occur with ascending or even erect stems. The scarious margins of the phyllaries vary in breadth and in tint, but are never nearly so broad or so black as those of var. *phæocephala*. The plant appears to be commonly biennial, but not infrequently perennial.

This is the form which reaches furthest south. It extends all down the western coasts of Europe and some way into the Mediterranean basin.

3. Var. PHÆOCEPHALA Rupprecht, Flores Samojedorum Cisuralensium in Beitr. zur Pflanzenk. Russ. Reich. 42 (1845).

Chrysanthemum grandiflorum Hooker f. in Parry, App. Sec. Voy. 398 (1825).

Tripleurospermum Hookeri Schultz Bipont. in Bonplandia, i. 151 (1853).

Rupprecht gives no formal diagnosis, but he devotes a whole page to the plant from which it is clear that the distinguishing feature is to be found in the very dark and generally broad margins to the phyllaries. He says: "In pluribus speciminibus e 12 diversis locis maris glacialis reportatis et alibi etiam a me examinatis nunquam squamas anthodii margine scarioso pallescente, ut in communi planta ruderali, sed fusco-nigricante et plerumque latissimo ornatas vidi." He goes on to say that all the German forms of *M. inodora* (including var. *salina* Wallr., which "insuper laciniis setaceis, brevioribus, valde confertis insignis est") have pale phyllaries, but acknowledges the possibility of the occurrence of transitional forms. It is interesting to contrast this statement with that of Fries (Summ. Veg. Scand. 186), who says that the essential character of "*M. maritima* L.," as he understood it, lay "in squamarum margine pallido integerrimo, qui in *M. inodora* semper lacero-, vulgo fusco-marginatus." Rupprecht describes his plant as very variable in height and ramification, from "3-pedalis et ramosissima" down to "simplicissima et semipollicaris" on the Island of Kolguev. He further says that it is a very common plant from Lapland, at least as far as Kotzebue Sound in Alaska, but does not indicate how far south it goes.

There are specimens in Herb. Brit. Mus. which seem referable to this variety from Caithness (*Marshall* 4086), Shetland (*Beeby*), and East Inverness (*A. Somerville*).

It is not suggested that every maritime form of *M. inodora* can be referred to one or other of these three varieties. There are many plants which it is difficult to know whether to assign to var. *salina* or var. *maritima*. But they do seem to represent recognizable types round which the transitional forms may be grouped.

Finally, attention may be called to Dr. L. M. Neuman's paper in *Botaniska Notiser*, 1882, pp. 167–175, in which he distinguishes 6 forms (he does not call them varieties), the descriptions of which are here reproduced. The synonyms given are Neuman's, with the references verified and in some cases corrected.

1. f. *Raii* ("Chamæmelum maritimum perenne humilius, foliis brevioribus crassis obscure virentibus." Ray, Syn. Meth. 186, t. 7. f. 1. This is the only synonym quoted by Linnæus for his *M. maritima*).

2. f. *minor* Fries, N. H. fasc. xii. no. 2.

3. f. *Friesii* (*Chrysanthemum maritimum* Fries, N. H. fasc. vii. no. 1. "*Matricaria maritima* L." of Fries Summ. Veg. Scand. 186).

4. f. *recentiorum* (*M. inodora* var. *maritima* Aresch. Sk. Fl. & Hartm. Sk. Fl. ed. xi. *Tripleurospermum maritimum* Koch, Syn. ed. 2, p. 1026 (1845). *Chamæmelum maritimum* L. It. vestg. 148. *Pyrethrum inodorum* var. *salinum* Wallr. Sched. 485 (1822).

5. f. *Retzii* (Retz, Prodr. Veg. ed. ii. 198, 1797). *Pyrethrum maritimum* Sm. corona lobata, Fries, Fl. Suec. 3. *Matricaria inodora* var. *coronata* Marss. Fl. von Neu-Vorpomman, 245 (1869).

6. f. *borealis* Hartm. Sk. Fl. ed. xi.

Neuman gives a key to the forms, of which the following is a translation :—

1. Stems decumbent, leaf-divisions round	f. *recentiorum*.
2. Stems erect, leaf-divisions flattened.	
†. Phyllaries entire-edged, without coloured margins	f. *Friesii*.
††. Phyllaries wavy or lacerate, with coloured margins.	
*. Low-growing, scarious margins wavy, rather tinted, interval between leaf and capitulum large, leaf-divisions short	f. *Raii*.
**. Low-growing, scarious margins wavy, rather tinted, interval between leaf and capitulum large, but leaf-divisions elongate	f. *minor*.
***. High-growing, scarious margins dark, lacerate, interval between leaf and capitulum small, ray florets short, reflexed..................................	f. *borealis*.
****. High-growing, scarious margins dark, lacerate, interval between leaf and capitulum small, but ray florets long, horizontal	f. *Retzii*.

Some of these forms probably occur on our northern coasts, and a look-out should be kept for them. Further study is required before they can be collated with the more familiar varieties. Rouy identifies his var. *angustiloba* with Neuman's f. *recentiorum* pro parte, but this seems to be the only case in which the attempt has been made recently. Neuman himself gives Wallroth's var. *salinum* as a synonym of his f. *recentiorum*, but his diagnosis of the form does not correspond with the plant which most botanists understand as representing that variety.

JAMES RAMSAY DRUMMOND.

(1851–1921.)

James Ramsay Drummond was born in Scotland on 13 May, 1851. He was educated at the Edinburgh Academy, the University of Glasgow, and New College, Oxford, becoming B.A.(Oxon.) in 1872. He was appointed to the Indian Civil Service in that year, reaching India in 1874. He served in the Punjab as Assistant Commissioner, District Judge, and Commissioner till 1904, the last few months of his Indian Service being spent in officiating as Curator of the Herbarium at the Royal Botanic Garden, Calcutta. He retired in 1905, and on reaching England settled at Kew, with the object of working out the extensive botanical collections made by him in the Western Punjab, the flora of which he knew intimately, as well as in the neighbourhood of Dalhousie and Simla and in the Gangetic plain. He had intended to prepare a *Flora of the Punjab*, a work he was fully competent to undertake, but owing to failing health he was compelled to abandon this undertaking. A few years ago he moved from Kew to Acton, where he died on 11 March, 1921.

A man of unusual versatility, Drummond had an unbounded enthusiasm for botany both in the field and in the herbarium. To a remarkable memory and wide knowledge were added in his case decided linguistic gifts and powers of exposition, all of which he was always ready to place at the disposal of fellow-workers. His published contributions were not numerous, and date mostly from after his retirement. One important contribution, largely the outcome of his studies at Calcutta just before leaving India, deals with the Agaves and Furcræas that have found their way into that country. This was published in the *Bulletin of the Royal Department of Land Records and Agriculture* in 1905, and was reprinted in the *Agricultural Ledger*, 1906. In connection with these studies he prepared an account of the "Literature of *Furcræa*, with a Synopsis of the Known Species" which appeared in the *Report of the Missouri Botanic Garden* for 1907. To this Journal for 1911 Drummond contributed his useful critical notes on the "Grewias of Roxburgh."

David Prain.

THE BRITISH RUBUS-LIST.

By the Rev. H. J. Riddelsdall, M.A.

A small MS. note-book compiled by the late Rev. W. Moyle Rogers has lately come into my possession, through the kindness of his son, the Ven. F. A. Rogers, Archdeacon of Pietersburg, S. Africa.

It contains a list of British *Rubi*, revised and rearranged up to date (April 1917) with vice-comital census numbers and illustrative notes—all prepared with a view to a new edition of the London Catalogue. It is perhaps not necessary at present to reproduce the list and notes in their entirety; but some points may be made, in supplement to the paper published last year in this Journal, p. 101.

Mr. Rogers does not include Focke's variety *plymensis* of *R. egregius* Focke (see Journ. Bot. 1914, p. 204); and the omission is probably intentional, as I find no cover for this form in his *Rubus* herbarium. *R. opacus* Focke is given specific rank at the head of the *Subrhamnifolii*. Under *incurvatus* are placed var. b. *rotundifolius* Rogers, "the usual S. England form" of *Handbook*, pp. 27, 28; and var. c. *subcarpinifolius* Rogers, "the Upper Wye Valley form," *ib.* p. 28. *R. Lindleianus* has a var. *latifolius* Rogers, the Co. Down variety of *Handbook*, p. 28. *R. chlorothyrsus* Focke finds no place in the list, and *R. amphichloros* P. J. Muell, though included, is placed in square brackets. Instead of *R. micans* Gren. & Godr., we are to revert to the name *R. adscitus* Genev.; our plant is certainly identical with Genevier's, whereas *proof* is at present lacking that Lefv. & Mueller's *hypoleucus* is quite the same. Rogers's var. *mollissimus* of *hirtifolius* stands.

The most important changes are found in Groups XI. & XII. After *pallidus* and var. are placed *R. glareosus* Rogers & Marshall, with census 5; *R. horridicaulis* P. J. Muell. 7; *R. rosaceus* Wh. & N., 34, and var. b. *Purchasianus* Rogers, 5; then *R. scaber* Wh. & N. to *R. foliosus* Wh. & N. The *Koehleriani* run:—*R. hystrix*, Wh. & N., 56?, var. b. *bercheriensis* Druce, 4, c. *infecundus* Rogers, 42, d. *adornatus* (P. J. Muell.), 21, e. *Powellii* (Rogers), 4; then *R. hostilis*, *R. fusco-ater*, and *R. Koehleri* onwards. Var. *minutiflorus* (P. J. Muell.) is retained under *R. hirtus* without sign of doubt; but c. *calcareus* Rogers MS., under *R. corylifolius* Sm., is omitted.

A NEW CALADENIA FROM WEST AUSTRALIA *.

By Oswald H. Sargent.

Caladenia Doutchæ, sp. nov. Herba terrestris tuberosa. *Folium* unicum 7–10 cm. long. ad 6 mm. lat., lanceo-lineare, acutum, subconduplicativum, utrinque viride, facie glabra dorso parce piloso. *Scapus* 15–30 cm., purpureus, parce pilosus, bractea vaginante lanceolata acuminata in medio itaque sub flore onustus. *Flos* unicus githagineus. *Sepalum* dorsale erectum lanceolatum acuminatum; sepala lateralia subdeflexa, lanceolata, dorsali latiora, marginibus revolutis, apices caudati, extrema caudarum fusiformia, rugosa. *Petala* deflexa, lineari-lanceolata, marginibus revolutis, apicibus acuminatis valde cincinnatis. *Labellum* latissime ellipticum, margine integra; lobo medio minuto, oblongo, obtuso, integro, reflexo; callis brevibus atque tenuibus, dorsiventraliter compressis, subclavatis, in seriebus 2–3 ordinatis. Gynostemium incurvatum, glandulis basalibus atro-purpureis majusculis; alis semiobpanduriformibus; anthera obtusa.

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* Co-type in National Herbarium.

Datatin, near Katanning; *Miss L. Doutch* (Herb. Sargent. 822, 866).

This new species closely resembles *C. Roei* Benth., from which it is readily distinguished by its definitely caudate sepals and purple-veined labellum with extremely small and slender calli. I have named it in honour of Miss L. Doutch, from whom I received it in September 1919. She was then in charge of the State School at Datatine near Katanning, and the species was collected not far from the school.

BIBLIOGRAPHICAL NOTES.

LXXXIV. The Compendium of Smith's 'English Flora.'

Under the heading "A Forgotten Essex Botanist" Mr. Miller Christy (*Essex Naturalist*, xix. 267–9) brings together such information as he could find about Æneas MacIntyre. His claims to be regarded as a botanist, as there set forth, are somewhat slight, resting as they do upon a good but not remarkable paper on the plants of Warley Common, published in the *Proceedings of the Botanical Society* in 1839. Our *Biographical Index* (not "Dictionary" as cited) gives, as Mr. Christy points out, only the most meagre information concerning him, and indeed we should have had some doubt as to including him in the second edition of our book, which is practically ready for printing, but for the discovery of certain information which establishes his claim to a place therein.

On our notes for this second edition we find a statement that MacIntyre prepared the *Compendium of the English Flora of Sir James Edward Smith*, which was published by Longman in 1829—Smith, it will be remembered, died in March, 1828. Neither Mr. Boulger nor I can remember whence we obtained this information, but there seems no reason to doubt its correctness. The compiler's name is nowhere indicated in the book, nor is the preface localised or dated; from it we learn that its preparation was suggested by the success of "the several editions that have already been sold of the *Compendium Floræ Britannicæ* and of some other manuals on the same subject, [which] are deemed sufficient proofs of the usefulness of a brief description of our native plants, which we may carry in our hands during our excursions into the fields. The present little volume, however,"—the preface continues—"besides exhibiting a concise yet comprehensive view of the latest improvements and discoveries contained in *The English Flora* and referring each genus to its place in the system of Jussieu, points out the groups that are natural, and furnishes short notices, occasionally, of the general habits and qualities of the more extensive Natural Orders. The English reader may also ascertain the accent of the Latin words, and of most of the Latinized terms, by means of the note which precedes the Index, and of the few words that are accentuated throughout the book." A description of the plan of the work, which "is the same as that of the *Compendium* mentioned above," follows; other additions to the matter taken from the *English Flora* are indicated in the concluding note, which states that "the figures annexed to the genera refer to the Orders of Jussieu; and those annexed to the species, to the volumes and plates of the 'English Botany.'" "The last four pages of the book, following the indexes, are occupied by the "Index to Jussieu's Orders," to which the figures attached to the genera refer.

It is thus evident that the *Compendium* is more than a mere compilation, and that the author was a competent botanist. The descriptions, based on the lines of the *Compendium Floræ Britannicæ* (which was in Latin) are very well done, and fully justify the author's anticipation of the usefulness of the book. Further evidence that it is rightly attributed to MacIntyre is suggested by its supplying the accentuation of the Latin names; Mr. Christy refers to a book published by him in 1836, entitled *Etymotonia*, "containing Principles of Classical Accentuation, intended as a Guide to the right Pronunciation of Greek and Latin words and of all Scientific Terms," "which shows its author to have been a very accomplished Latin and Greek Scholar." Since the publication of his paper, Mr. Christy has informed me that he has learnt that in 1823–4 MacIntyre kept a large private school at Stockwell Park, Surrey, which apparently was not a successful venture.

In 1836 appeared the second edition of the *Compendium*, "with additions and corrections by W. J. Hooker." It may be supposed that the publishers thought that the book, which was presumably their property, would obtain greater prominence if it appeared under the auspices of a well-known botanist whose *British Flora* was at that time the standard work of reference, for MacIntyre was then alive; his name appears in the list of Fellows of the Linnean Society for 1843, with the initials "LL.D." appended. Mr. Christy can find no explanation of this degree, nor of "V.P.M.S.L.," which also follows MacIntyre's name in Proc. Bot. Soc. Lond. It may be noted that the date of his "floruit" in the *Biographical Index* is almost certainly erroneous; the last reference to him, so far as we know, is in the Linnean list cited.

For the second edition, also published by Longman, the *Compendium* was reset; it was printed in Glasgow, where Hooker was then Regius Professor of Botany. The preface, beginning with an odd misprint—"A principal boject of Botany,"—is practically identical with that of the first edition, a reference to "the third edition of the first vol. of *The British Flora* of Dr. Hooker" being added. The "Index to Jussieu's Orders" is omitted, though the figures in the text relating to it are retained; numerous species (indicated by a prefixed asterisk) are added, with notes on some of the species; the revision was evidently careful and thorough. This edition was reissued without alteration (save for the correction of the misprint indicated above) in 1844, and for a long time held its place as a useful guide to British plants.

The paper on the plants of Warley Common, on which MacIntyre's reputation as a botanist has hitherto rested, appeared, as has been said, in the *Proceedings of the Botanical Society of London* in 1839 (pp. 16, 21). Mr. Christy's allusion to this is a little misleading; MacIntyre does not "enumerate" 701 species, but merely states that that number occur: only a few are mentioned by name, among them "*Doronicum plantagineum, Borago orientalis,* and *Linaria bipartita,* [which] have not, I believe, been elsewhere in England noticed growing apparently wild, certainly in this situation spontaneously": MacIntyre had previously "communicated" a list of Warley Common plants to Daniel Cooper for publication in his *Flora Metropolitana* (1836).

James Britten.

SHORT NOTES.

Rosa spinosissima × rubiginosa f. cantiana, *forma nova.* The following is the description of the hybrid (named but not described in Journ. Bot. 1920, Suppl. 1, p. 5) hitherto known as *R. biturigensis* Bor., from which it differs in its glandular-hispid peduncles and fruit.

Frutex humilis. Aculeis densis heteracantheis *R. spinosissimæ*, foliolis parvis suborbicularibus biserratis *R. rubiginosæ*, supra glabris inferne in nervis mediis lateralibusque pubescentibus, glandulis prominentibus odoratis plus minusve tectis; pedunculis fructibusque plus minusve dense aciculatis; fructibus globosis vel late ovoideis; sepalis patentibus suberectisve, subpersistentibus, raro subpinnatis; stylis hispidis, non extrusis.

A low-growing shrub, with the dense mixed armature of *R. spinosissima*, and the small suborbicular biserrate leaflets of *R. rubiginosa*, which are glabrous above and hairy on midribs and primary nerves beneath, with more or less copious prominent scented subfoliar glands; peduncle densely aciculate, and fruit more or less so; fruit globose or broadly ovoid, with spreading or suberect subpersistent sepals, rarely furnished with pinnæ; styles hispid, not extruded.

It seems to be near the Continental var. *Friesiana* R. Kell. which I know only from his description, and which appears to differ in its leaflets being pubescent on both sides, and in its few aciculate prickles. It may also be very near *R. involuta* f. *Nicholsonii* Crép., of which I have not seen authentic specimens.

My hybrid is described mainly from specimens gathered at Boxley Warren, E. Kent, but very similar forms have been found in Roxburgh, Haddington, and E. Perth.—A. H. Wolley-Dod.

Alexander Irvine. I have recently placed in the Department of Botany an interleaved copy of Alexander Irvine's *London Flora* (1838) which was given or lent to me by the author between fifty and sixty years ago. It contains a revision of the introduction on a more extended scale, which was in part utilised in his *Illustrated Handbook of British Plants* (1858), and a large number of additional localities, chiefly of Surrey plants, doubtless entered during his residence at Albury and Guildford, before he went to Chelsea in 1851. There are also numerous notes on the plants collected in 1853–60 near the Wandsworth steam-boat pier, where were deposited the siftings and sweepings from an adjoining distillery: these formed the subject of a long and characteristically discursive paper from Irvine's pen in the *Phytologist* for 1859 (iii. 330–350) and are referred to in numerous other communications in the same journal. An interesting biography of Irvine, by his friend William Pamplin—his companion in the rambles of "W. P." and "A. L." chronicled in the *Phytologist* (N. S.)—is given in the *Gardeners' Chronicle* for 1873, p. 1017. Reference is there made to the "pastoral or ministerial office over a branch of the church" held by Irvine during the later part of his life: this was the Catholic Apostolic, or Irvingite, Church, to which community Trimen also belonged. A notice of Irvine from Trimen's pen will be found in this Journal for 1873 (p. 222) in the course of which Irvine's uniform kindness to "young enquirers and beginners" is mentioned. To this I am able to bear personal testimony: in 1862–4 I was a frequent visitor to his little house in Upper Manor Street, Chelsea—the back garden of which was full of *Sonchus palustris*, brought originally from Woolwich—and was indebted to him for the loan of many books from his rather extensive library, the contents of which were offered for sale in catalogues issued in connection with the *Botanists' Chronicle* (1863-65) edited and published by Irvine at his residence. His son James shared his father's interest in botany: after his father's death he became a second-hand bookseller, but it is many years since I last heard of him.—JAMES BRITTEN.

THE JERSEY HERNIARIA. In the account of the genus *Herniaria* in volume iii. of the *Cambridge British Flora*, Dr. Moss has followed my arrangement of these plants in Journ. Bot. lii. 330 (1914) in transferring the Jersey form described by Babington from *H. glabra* to *H. ciliata*. He retains, however, Babington's varietal name *subciliata*, which I think is inadmissible. Babington (*Primitive Fl. Sarn.* p. 39) described the plant as *H. glabra*, dividing it into two varieties, viz.:—*a. vera*—foliis glabris (St. Aubin's Bay, Guernsey, Alderney), and *β. subciliata*—foliis plus minusve ciliatis (in very small quantity at St. Aubin's Bay); and owing to its general facies he failed to recognize its relationship with *H. ciliata*, which he had described as a new species only three years previously. Mr. Lester-Garland, in his *Flora of Jersey* (p. 73), also treats the plant as *H. glabra*, and remarks that "Babington's variety *subciliata* is absurd." There is evidently one form only in Jersey, varying in the ciliation of the leaves, which is quite a minor character; and Babington's account gives no indication of its real peculiarities. In describing this plant under *H. ciliata*, Dr. Moss states that it is *H. glabra* var. *subciliata* Bab. Prim. Fl. Sarn. p. 39, and that, although the Latin diagnosis is meagre, it is sufficiently described. But the plant is dealt with by Babington as *H. glabra* (including both var. *vera* and var. *subciliata*), and his points of distinction quoted by Dr. Moss refer not to his variety *subciliata*, but to his *H. glabra* as a whole.

If the plant, therefore, is placed under *H. ciliata*, it should stand thus: *H. ciliata* Bab. var. *angustifolia* Pugsley in Journ. Bot. lii. 331 (1914) = *H. glabra* (var. *vera* and var. *subciliata*) Babington, Prim. Fl. Sarn. 39 (1839); Lester-Garland, Fl. Jersey, 73 (1903); non Linn. = *H. ciliata* var. *subciliata* Moss in Camb. Br. Fl. iii. 10 (1920). This form does not seem to have been mentioned elsewhere by Babington, and I cannot find any allusion to it, even indirectly, by Syme or Hooker. Dr. Moss's remark that British botanists know quite well the plant intended seems very questionable. A sequence of this treatment is that under *Herniaria glabra* L. Dr. Moss adopts the name *H. glabra* var. *vera* Bab. Fl. Sarn. 39 (1839) to represent the specific type, thus making the usual form of this Jersey perennial stand for the annual plant of the Eastern Counties—a course that can only be defended owing to the lack of precision in Babington's description.—H. W. PUGSLEY.

DRABA MURALIS IN GLOUCESTERSHIRE. Swete (Fl. Bristol, p. 8: 1854) recorded this from an old quarry at Henbury, where Miss Powell has "found it plentifully for several years past"; Mr. White (Bristol Fl. 155: 1912) has seen specimens collected by her in 1834, and St. Brody's herbarium contained a specimen from the same locality gathered in 1871. Mr. White (*l. c.*) doubted the probability of its nativity there. "many miles from an undoubted native locality": I have however a record, dated 1908, from Kingscote, Nailsworth, and the *British Flora* gives a good many Somerset localities. The probability of *D. muralis* being native in v.c. 34 has been recently increased by its discovery by Mr. J. W. Haines, on an old broken down wall, in an out of the way part of the Forest of Dean. It is in some quantity here, and may perhaps be found on native soil in the neighbourhood: no other introduced plants were observed with it, except Sedums and the usual denizens of a wall flora.- H. J. RIDDELSDELL.

REVIEWS.

A Handbook of the British Lichens. By ANNIE LORRAIN SMITH, F.L.S. 8vo, cloth, pp. 158, with 90 figures in the text. British Museum (Natural History), London, S.W., 1921. Price 6*s*. 6*d*. net.

THIS volume fills a gap which has been very evident for many years to those interested in lichens. After a brief introduction, in which some aspects of the morphology, histology, and ecology of lichens are considered, the book becomes a useful and much needed key for placing these plants under their proper families, genera, and species. Hitherto British lichenologists have made keys for themselves, or have used foreign ones. There are many disadvantages in using a clavis intended for another country, which necessarily includes plants that are absent from our islands while it omits some that are present and neglects the peculiarities of our island flora.

As a test of the value of the book, I took a batch of lichens which I had recently named, and in every case except one the use of the key enabled me quickly to allocate the plant to its proper species. The test was a severe one, as the lichens were *Ramalina Curnowii*, *R. breviuscula* (which of course came under *R. siliquosa*, under which it is placed in the *Monograph of British Lichens* as a subspecies), *Lecania prosechoides*, *L. prosechoidiza*, *L. erysibe* var. *sincerior*, *Lecanora polytropa*, *Lecidea latypea*, *L. protrusa*, *Verrucaria viridula*, and *Arthopyrenia stigmatella*. In *Bilimbia aromatica* the spores in my specimen were rather larger than is given in the key, but it was easily run down. The only case in which the key failed was an unfair test—the plant was *Ramalina subfarinacea*, collected near Penzance from the branches of hawthorn, a very unusual habitat; I have indeed seen no British record of it save from rocks, and had never previously noticed it on trees. As the key only takes account of its saxicolous habitat, this anomalous plant was of course difficult to place. The example will however serve to illustrate the fact that there is no royal road to the determination of many species, and that a supplementary use of the *Monograph of British Lichens* is necessary for critical species and for those which are not exactly typical in respect either of structure or habitat. Another example is afforded by *Ramalina farinacea*; the key relies on its arboreal habitat, but it occasionally occurs on the sand of grey dune. To include all such erratic characters is not the purpose of the *Handbook*, and such inclusion would destroy its portability; one of its great advantages is that it is convenient for carrying in the pocket.

The main part of the work is more than a key: much information is given about the structure and ecology of the various lichens and a typical species of each genus is figured. The classification and nomenclature followed is that of the *Monograph*, of which any criticism would here be out of place. Where generally-known names have been superseded, the useful course of giving such names in brackets has been adopted.

The instructions on p. 13 in regard to the composition, use, and interpretation of chemical reactions are too concise to be exactly clear. The apothecium figured on p. 8 (reproduced from the *Monograph*) conveys the idea that a biatorine apothecium has a different internal structure from a lecideine one, which may not be the case: a biatorine hypothecium often only differs from a lecideine one in its external colour. The inclusion of algal cells below the hypothecium suggests a lecanorine apothecium in which the thalline margin has become obsolete. The rarity of typographical errors testifies to the care exercised in proof-reading: on p. 54 *subintricata* should replace *subimbricata*, and a comma has crept in between "Primary" and "thallus" (p. 71, line 3), in the wonderfully active way that commas have—there seems to be an affinity between them and their bacterial namesakes. The statement that "*Cladonia rangiferina* "is the well-known reindeer-moss ' needs a little amplification, owing to the difficulty of distinguishing between *C. rangiferina* and *C. sylvatica*. A general key for placing plants under their proper genera would have been useful and need not have seriously increased the size of the book, whose price places it within the range of the ordinary student. It must be emphasized that in cases of doubtful, critical, or non-typical plants the *Handbook* cannot be substituted for the more complete *Monograph* by the same author.

W. Watson.

Aspects of Plant Life with special reference to the British Flora. By Robert Lloyd Praeger. (Nature Lover's Series.) 8vo, cloth, pp. 207, illustrated. S. P. C. K. 6*s.* net.

Mr. Praeger's pleasant and eminently readable style makes his books ideal for holiday perusal. The "Nature Lover" will from this book learn much of where, why, and how, plants grow in their homes, how they spread (dispersal) and colonise (migrate). Moreover, the information is very accurate, a rare thing in a popular book; it is scarcely to the author's discredit that he "does not attempt to make botany as amusing as fiction, as Grant Allen did in the *Story of the Flowers*"—to quote from a newspaper review of the work. The biology of the flower, the relations between "Plants and Men" and "Plants and Animals," as well as the plant itself and its life's work, are all interestingly outlined, and technical terms are so introduced as to make them seem real friends. In "Past and Present" the origin of the British flora is discussed, and in the last chapter "some interesting plant groups" are described. Mr. Praeger has not noticed the interesting contribution to *Knowledge* (Dec. 1916), in which Mr. C. L. Withycombe shows that the accepted story of the *Utricularia* is erroneous. The bladders have the sides drawn in when empty. A touch on the bristles causes the bladders to expand violently and suck in the intruder: the suction power was sufficient greatly to distort the head of a small tadpole whose tail was caught in an adjoining bladder. Darwin's failure to find irritability was due to insufficient observation.

The print and paper are good, the figures sufficient, although the frontispiece of Desert Plants seems rather out of place. The index is inadequate and the colour scheme of the cover does not please us, but these are small blemishes in an excellent little book.

A. J. W.

BOOK-NOTES, NEWS, ETC.

Robert Allen Rolfe, whose death at his residence at Kew on April 13, after a long illness, we briefly chronicled in our last issue, entered the Royal Gardens in 1879, and in the following year obtained by competitive examination a post in the Herbarium. There he devoted himself especially to the *Orchidaceæ*, on which order he soon became our leading authority, the value of his work being generally recognised. In 1893 he established *The Orchid Review*, which he conducted with marked ability and sometimes at pecuniary loss until the end of last year. But although it is in connection with Orchids that Rolfe's name will chiefly be remembered, much good work in other orders stands to his credit. He paid special attention to the *Selagineæ*; his paper on that order (Journ. Linn. Soc., Bot. xx. 338–358: 1883), as described by Linnæus and other early authors, is a good example of his careful work upon old types, and he subsequently monographed the Tropical and South African species for the Floras of those regions. His contributions to this Journal included notes on Formosan plants (1882, 358), a revision of *Donax* and *Schumannianthus* (1907, 242), the description of a new variety (*virescens*) of *Ophrys muscifera* (1907, 282), and a paper on *Rubus fruticosus* (1916, 55), his conclusions as to which elicited a protest from British batologists (*op. cit.* 181). Rolfe contributed to Journ. Linn. Soc. xxi. 283 (1884) an important paper on the Flora of the Philippine Islands, to which he had paid much attention; his help is acknowledged by Vidal in *Phanerogamæ Cumingianæ Philippinarum* (1885): he also contributed to the Kew publications. He was an Honorary Fellow of the Royal Horticultural Society, at whose meetings he was a regular attendant, and in 1885 was elected an Associate of the Linnean Society. A tribute to his personal character is paid in the *Gardeners' Chronicle* of April 23. His forty years' service at Kew was one long period of perseverance and steady performance: his achievement is the more remarkable in that he was seriously handicapped by deafness. He is commemorated in the genus *Rolfea*—a name substituted by Zahlbrückner for *Jenmania*, which had been been bestowed by Rolfe upon a Guiana orchid in ignorance that it was preoccupied (see Journ. Bot. 1898, 493).

At the meeting of the Linnean Society on April 21, Prof. R. Newstead delivered a lecture, entitled "Some Observations on the Natural History of the Upper Shiri River, Nyasaland." The flora was dealt with under three sections:—(1) the river and its banks, (2) the open "dambo" or savannah, and (3) the forest. As regards the flora of the river, attention was called to the plants forming the fringe of the sudd, namely *Pistia Stratiotes* and *Trapa bispinosa.* The width of the sudd in the river a little south of the Lake Malombe was given as approximately thirty-seven yards on either side; the width, however, varied at different points. The banks of the river in places were clothed with more or less dense vegetation, consisting of a few palms, the Baobab (*Adansonia digitata*), *Kigelia* sp., with here and there the scarlet-flowered climber *Combretum microphyllum*, etc. In the open dambo, during the dry season, the plants were nearly all resting; the commonest was a species of *Asparagus* and an undetermined species of Leguminosæ. The forest proper is fringed on the river-side by Acacias of various species, of which flat-topped species predominated; hereabouts the *Euphorbia grandidens* (?) was also very common. In the forest the tree most commonly met with was the Iron-wood, *Copaifera Mopane.* Ebony (*Diospyros* spp.) was also fairly common, and so also was a species of *Parkia.*

The Kew Bulletin (no. 2, April) contains descriptions of "New or Noteworthy South African Plants," by J. Burtt Davy; Decades 48–49 of "New Orchids," collected by Sir Everard im Thurn mostly in the Fiji Group, described by the late R. A. Rolfe; "Notes on *Colletotrichum* and *Phoma* in Uganda," by W. Small; and a paper on "Kikuyu Grass" (*Pennisetum clandestinum* Chiov.) by Dr. Stapf.

In the *Bulletin of the Torrey Club* for March Mr. S. F. Blake gives a description of *Neomillspaughia*, a new genus of *Polygonaceæ* based on *Campderia paniculata* Donn. Sm., with remarks on allied genera: Mr. F. W. Pennell has discovered Rafinesque's *Autikon Botanicon*, "which, while pretending to be but a catalog (*sic*) of specimens for sale, is actually a study abounding with generic and specific descriptions but is never cited in the Kew Index," and was apparently unknown to Asa Gray. "This paper is the first of several in which [Mr. Pennell will] attempt to record briefly the unrecorded genera of Rafinesque, upon what they are based, and whether the names are available for use": the present instalment contains 84 of these names! We do not think botanists generally will congratulate Mr. Pennell or themselves on the discovery.

The *Botanical Gazette* for March contains a paper by L. E. Miles on "Leaf Spots of the Elm," with three plates; J. H. Schaffner writes on the "Influence of Environment on Sexual Expression in Hemp" (1 plate); Edith S. Whitaker reports "Experimental Investigations on Birch and Oak" (4 plates); and Theo Holm contributes a notice, with portrait, of the late John Macoun.

The *Journal of the Arnold Arboretum* for January, lately to hand, contains a "Botanical Reconnaissance of Southern Illinois," by E. J. Palmer; a continuation of Prof. Sargent's "Notes on North American Trees," including a new species of *Halesia* (*H. monticola*) and several new varieties; "New Species, Varieties, and Combinations," by Alfred Rehder; and useful "Bibliographical Notes," by Ethelyn M. Tucker, in which the "Nouveau Duhamel" and Torrey and Gray's *Flora of North America* are dealt with. The number also contains a paper in which Mr. Rehder discusses the application of the names *Azalea* and *Loiseleuria*, and arrives at the following conclusions: "*Azalea* Linnæus is based chiefly on *A. procumbens* which must be considered the type of the genus. According to the International Rules, *Loiseleuria* which also is based on *A. procumbens* is a *nomen conservandum* and therefore the name to be adopted for *A. procumbens*; *Azalea* Linnæus thus becomes a synonym of *Loiseleuria*. According to the Philadelphia Code *Azalea* Linnæus must be considered the valid name for the genus now generally called *Loiseleuria*, another name *Azalea* in the conception of Britten and Small must be replaced by *Tsutsusi* Adanson."

In a handsome quarto volume published by Det Kongelige Norse Videnskabers Selskab (Contrib. ad Fl. Asiæ Interioris Pertinentes, vol. iii.) Henrik Printz gives an account of *The Vegetation of the Siberian-Mongolian Frontiers*, based on the collection of vascular plants observed during his journey in the summer of 1914 in Southern Siberia and north-western Mongolia. The contents include a full description of the phytogeographic relations of the regions traversed and an enumeration of the plants observed, with critical notes and illustrations in the text; there are also twelve plates, reproduced by photography, in which new species or subspecies of *Carex*, *Ranunculus*, *Aconitum*, *Veronica*, *Taraxacum*, *Pedicularis*, *Papaver*, and *Oxytropis* are represented.

The *Annali di Botanica* (28 Feb.) is devoted to "Nuove richerche sulla embriologia delle *Asteraceæ*" by Dr. E. Carrano, with nine plates from drawings by the author.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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NEW BRITISH SPHAGNA.

By J. A. Wheldon.

Sphagnum rubellum Wils. var. sordidum Warnst. seems to have a decidedly northern range in Britain. In addition to the ordinary form, two rather striking variations with well-marked facies occur. The first, forma *immersa* Warnst. (*Sphagn. Universalis*, 1911, p. 77), is a tall more or less remotely fascicled plant, almost approaching states of *S. fuscum* in its general colour, but with a dull reddish or purplish tinge in the capitulum or upper branches. It occurs in deep wet bogs in the following localities:—Killimster Moss, The Flow of Leannas, and near Ramscraig, Caithness (*D. Lillie*); Lamancha Moss, Peebles (*J. Archer*); Meathop Moss, Westmorland (*W. West*); Moor, above Ravenscroft, N. Yorkshire (*Ingham*). The second form referred to is much smaller, very compact, and rigid, and forms small very dense cushions in exposed alpine or boreal localities. It may be described as follows:—Forma densum mihi. Planta pusilla 3–8 cm. alta, cæspitibus densis. Ramorum fasciculi densissimi, rami patuli breves imbricate foliosi.

It has been sent to me from the following localities:—Stromness, Orkney (*Grant*); Stratley and Hope Bridge, W. Sutherland (*Lillie*); Camster, Caithness (*Lillie*); Cairngorm at 3500 ft., East Inverness (*Wilson & Wheldon*).

Sphagnum plumulosum Roll. var. ochraceum Wft. occurs frequently in the north of England, and more rarely elsewhere, in a very robust orthoclade form, which does not appear to have been described. It may be distinguished from other robust forms of the variety, such as f. *Schillerianum* and f. *immersum*, as follows:—

Forma orthocladum mihi. Cæspites densi ad 15 cm. profundi. Planta robusta, superne pallide sordido-violascens vel dilute fuscescens, capitula tantum ochracea. Ramorum fasciculi cumulati et rami patuli ascendentes.

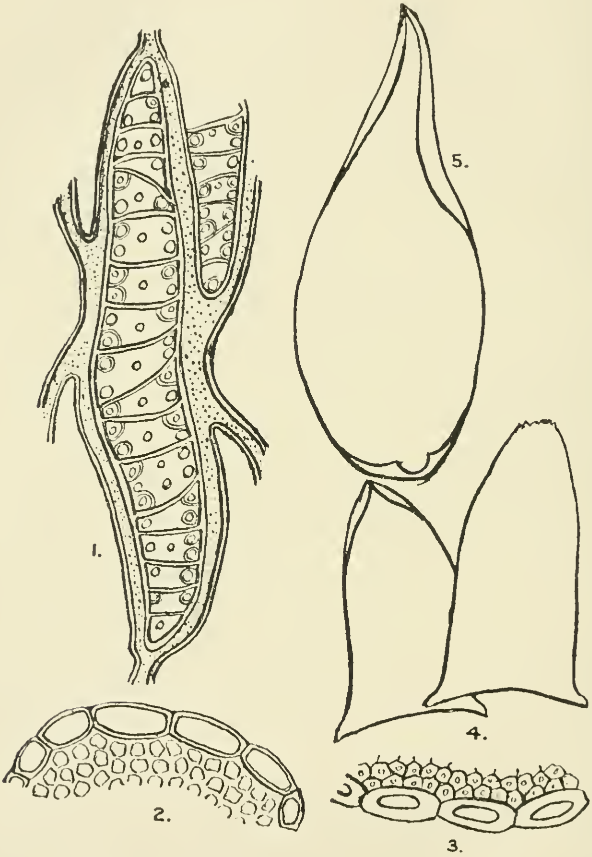
White Force, Wheeldale, and Scarth Nick, North Yorkshire (*Ingham*); Eskdale, Cumberland (*Wilson & Wheldon*); Hartfield, Sussex (*E. S. Salmon*); Dartmoor, Devon (*H. J. Wheldon*); Prill Dingle, Herefordshire (*Armitage*); Slieve Donard, Co. Down (*Lett*).

One feels some hesitation in describing as a new variety a Sphagnum which has only been found in a single locality. But in this genus we are dealing with a disappearing section of our Flora, and the process of extirpation looks like being speeded up in the near future: there is no known habitat in which, for instance, so fine a plant as *S. riparium* may now be found. It seems desirable therefore to place on record, if only as of historical interest, such plants as the next three to be described.

Sphagnum obesum Wils. var. devoniense Sherrin & Wheldon. Planta submersa, sæpius divisa 5–12 cm. longa, viridis sursum subviolascens. Fasciculi ramorum remoti et plerumque ramis patulis 3–4; rami patuli crassi. laxe foliosi. Folia ramorum (3–4 mm longa plerumque aporosæ) superiorum imbricata, inferiorum erecte patentia. Folia caulina ovato-lingulata 1·5 mm. longa. Cellulæ hyalinæ sæpe multifibrosæ septatæ utrinque multiporosaque.

Chumleigh, North Devon, Jan. 1918, *T. B. Fry*.

The features of the variety are the bright green colour lightly stained with violet here and there near the capitulum, the leaves on the upper branches imbricate, on the lower laxly patent, the aporose branch-leaves, and multiporose stem-leaves.



1. Cell from back of branch-leaf of *S. hercynicum* var. *Binsteadii* Wheld. 750/1. 2. Transverse section of stem of ditto. 375/1. 3. Transverse section of stem of *S. hercynicum*, type (after Warnstorf). 375/1. 4. Stem-leaves of var. *Binsteadii*. 30/1. 5. Branch-leaf of var. *Binsteadii*. 30/1.

SPHAGNUM AQUATILE Warnst. var. OCHRACEO-VIOLASCENS Warnst. f. PACHYCLADUM mihi. Rami patuli crassi turgescentes breviter acuminati sæpe intorti, folia eorum plus minus imbricata permagna, quasi 3–3·5 mm. longa.

Throwleigh, South Devonshire, 1918, *W. R. Sherrin.*

Mr. Sherrin's specimens are about 16 cm. high, stained in the upper part of a deep, almost blackish, violet colour, and differ materially from the var. *ochraceo-violascens* in the imbricate and much larger branch-leaves. Both in colour and habit it is a striking form.

In April last the Rev. C. H. Binstead collected on Cefn Hill, Herefordshire, an interesting Sphagnum of the group *Subsecunda*, which was sent to me for examination by Miss Armitage. It was found to differ from any of the British species of that group, but rather to form a connecting-link between *S. hercynicum* Warnst. and *S. inundatum* Warnst. The latter is a common and very widely distributed member of the group, but the former is a little-known continental species which has not hitherto been detected in Britain. It was described by Warnstorf from material collected in the Harz Province by Dr. Huber in September 1884. The exact habitat appears to be unknown, and it has not, so far as I am aware, been been found since, either in the original locality or elsewhere. In the Warnstorfian arrangement it is placed between *S. subsecundum* Nees and *S. inundatum* Warnst., and, for this group of what may be called "small species," it exhibits very distinctive characters, which entitle it to separation. The cells of the stem-leaves are multiporose on both sides, those of the branch-leaves on the outer surface only. But in both types of leaf, in addition to the usual commissural pores of this group, are to be found smaller perforations (winzige Löcher), which are very distinctive. They occur either scattered or in one (rarely two) row in mid-cell between the rows of commissural pores. Another and perhaps more striking feature is the structure of the hyalodermis of the stem. The enlarged cells are in one layer. In transverse section, instead of the usual subrotund polygonal outline of neighbouring species, they are elliptical and transversely elongate, and their walls are described as strongly incrassate.

As Mr. Binstead's plant has the pore-structure of *S. hercynicum*, one hesitates to place it under *S. inundatum*, especially as the examination of very many examples of our ordinary plant have been made without the disclosure of any small pores situated as in *S. hercynicum*. Very rarely the stem-leaves of *S. inundatum* show, on the outer side of one or two of the cells near the apex, a few ordinary pores in mid-cell, but in such cases the commissural pores disappear. The hyalodermis of the Cefn plant, moreover, shows cells which are elliptical in cross-section, usually twice and at times thrice as long as wide. They differ from those of typical *S. hercynicum*, as figured by Warnstorf (vide *Sphagnologia Universalis*, 1911, p. 327, fig. 55), in their much thinner walls.

It seems so universal a rule for the enlarged epidermal cells of both Sphagna and true Mosses to have thin-walled cells, that one is led to suspect that the very stout walls attributed to those of *S. hercynicum* may be pathological. If normal, their structure is so divergent from the ordinary as almost to entitle this species to be placed in a monotypic section of the genus. Owing to the rarity of *S. hercynicum* we have no knowledge of its variability, and no conclusion can be reached as to whether the thickness of the cell-walls is constant. As variability seems to be the most universal attribute of Sphagnum characters, one may legitimately infer that, if *S. hercynicum* were better known from a wide range of habitats, it would be found occasionally to show thinner-walled cells, such as are seen in Mr. Binstead's plant and in the vast majority of the Sphagna. The evidence seems conclusive that the Cefn specimens are certainly nearer *S. hercynicum* than *S. inundatum*. The fact that the latter is a common British plant, and the former hitherto restricted to the Harz district, would have more weight were not the distribution of many species of Sphagnum so eccentric. Some, like a few common lichens and mosses, are of world-wide range; others restricted to very limited areas, and a few occur sporadically in localities widely separated by oceans and continents. At present, therefore, it seems desirable to subordinate Mr. Binstead's plant to *S. hercynicum* as a variety, rather than to *S. inundatum*, though it may ultimately prove to be a new endemic species. The following diagnosis indicates the chief features separating it from typical *S. hercynicum* Warnst.:—

Var. nov. BINSTEADII, mihi. Planta robustiora, quasi 10 cm. alta, viridis, sursum sublutea. Ramorum fasciculi plus remoti. Faulia caulina paulo majora 1·5 mm. longa, 0·7 mm. lata; folia ramulina 1·4–1·8 mm. longa 0·7–0·8 mm. lata. Hyalodermis caulis strato uno, cellulæ sectione transversali ellipticæ, cum parietes non valde incrassatæ.

Cefn Hill (alt. 1500 ped.), Herefordshire, 27 April 1921. Leg. C. H. Binstead.

The stem-leaves of our *S. aquatile* W. occasionally have a few pores in mid-cell on the outer side of the leaf, but its other characters will prevent it being mistaken for *S. hercynicum*.

In *S. armoricum* Warnst., a plant of Brittany, the stem-leaves have a similar pore-structure to those of *S. hercynicum*, but the branch-leaves differ in being multiporose on both sides, without the supplementary row of median pores, and the cells of the hyalodermis are of the ordinary roundish outline.

NOTES ON BRIDELIA.

By H. H. HAINES, C.I.E., F.L.S.

I. BRIDELIA MONTANA Willd.

Bridelia montana as described by J. D. Hooker in the *Flora of British India* (v. p. 269) is attributed to Willdenow (Sp. Pl. iv. p. 978; 1805); the references arranged chronologically are:—*Cluytia montana* Roxb. Cor. Pl. ii. 38, t. 171 (1798); *Bridelia montana* Willd. l. c.; Wall. Cat. 7879 in part (1828); Roxb. Fl. Ind. (ed.

Wallich) iii. 735 (1832); Muell. Arg. in DC. Prodr. xv. ii. 500 (1866); Beddome, For. Manual, 202 (1873); Brandis, For. Fl. 202 (1873); Gamble, Man. Ind. Timb. 357 (1881). The distribution is given as "Along the foot-hills of the himalaya, ascending to 3000 ft. and to 6000 ft. in Sikkim, from the Panjab to Bhotan. Khasia Mts., alt. 2–4000 ft. Behar, on Parasnath, J. D. Hooker. Coromandel (Roxburgh)."

An examination of the material and a comparison with the descriptions and figures in the works cited, together with a consideration of the distribution, has shown that two or more species are here included; indeed, Hooker himself says: "There are two forms, one with leaves very shining above and narrowed base, nerves 8–12 pair slender, the other has leaves more like *retusa*, more oblong, nerves 10–15 pair stronger."

Roxburgh (Cor. Pl. l. c.) has a full description and a plate of *Cluytia montana*. He depicts a branch of a tree or shrub with leaves, 1·5–2·5″ long, with only 7–8 sec. nerves each side, turning up inside of, but neither branching nor uniting with the marginal nerve. The flowers are few in a cluster, the bracts inconspicuous, petals orbicular and clawed in both sexes, and the female disc is tubular, with a crenulate margin, closely investing the ovary but leaving its apex free. His plant is a native of the Peninsula and has a Telinga name. There is no specimen bearing Roxburgh's ticket at Kew, the British Museum, or at the Sibpur Herbarium, nor any known to me which can be said exactly to match the plate quoted or the original drawing from which the plate was made.

Willdenow's only reference is to *Cluytia montana* Roxb.

II. Bridelia verrucosa, sp. nov.

Wallich's No. 7879 in the Wallichian herbarium includes no plant referable in my opinion to Roxburgh's *Cluytia montana*: the only part which here concerns us is (d), marked "Helaundah, 13th Decr. 1820" from Nepal. This is obviously the part referred to in Fl. Br. Ind. and is the same species as Hooker's plant collected on Parasnath; these specimens belong to the second of the two forms referred to in his note cited above. The plant is one very familiar to me in its natural state over a large part of its known distribution. It is native of the lower Himalaya, abundant in the higher Siwaliks, and also occurs in the ravines of the mountains of Chota Nagpur (in which tract Parasnath also is situated); but there is no evidence that it occurs in the Peninsula proper. The branches are always markedly pustulate or verrucose, a character which Roxburgh would assuredly have remarked had it occurred in his plant. The leaves are very much larger, usually 4–6″ long on the flowering branches and the lower ones attain 8″ by 4·5″. There are 10–16 strong secondary nerves on each side, which run without branching into the marginal nerve. The flowers are in dense clusters on axillary tubercles densely covered with conspicuous broad scarious bracts; the female flowers have a villous or pubescent broad-based calyx-tube longer relatively to the sepals than in *C. montana*. The female disc loosely but completely invests the ovary and closes with a narrow 2–4 toothed mouth round the base of the styles; but I have recently found that in a Siwalik specimen the disc is laciniate and this, in conjunction with the variation noted under *B. Hamiltoniana* appears to indicate that the disc is rather a variable character in the genus. When entire it is usually circumsciss round base and is carried up as a calyptra on the young fruit; the latter is ellipsoid or ovoid-oblong, not globose as in *B. retusa* and *B. montana*. For this species I propose the name *Bridelia verrucosa*.

Hooker's specimen from Parasnath may be taken as the type, and Wallich's from Nepal, Griffith's No. 4887 (Darjeeling) and my specimens marked Chokamb (Siwalik Mts.), at Kew, are all typical. Karl Gehrmann (Eng. Jahrb. xli. Beibl. 95, 39 June 1908) says of *B. montana* " Die grossen kahlen eiformigen bis verkehrteiformigen Blätter mit randlaüfigen Sekundärnerven, grauschimmernder Unterseite (dann die kahlen brakteen und die pfefferkorngrossen runden Kapselfrüchte) charakterisieren die Art sehr scharf." With the exception of the part placed in brackets this is a good partial description of *B. montana* Hook. f. or *B. verrucosa* mihi, but not of *B. montana* Willd., to which the bracketed portion applies.

Wallich's No. 7879, called *B. montana* (mentioned above) was referred by Muell. Arg. l. c. p. 493 to *B. retusa* var. *squamosa*: and as this is identical with Lamarck's *Cluytia squamosa* the question arises as to whether the name *B. squamosa* Gehrm., should not be applied to our plant. Lamarck quotes Rheede's figure (Mal. ii. 23, t. 16) which almost certainly represents a form of *B. retusa* as identified by Mueller, and not our *B. verrucosa*. Roxburgh's Fl. Ind. (l. c.) evidently refers to the same species as is described in his *Coromandel Plants*.

Mueller in the *Prodromus* (l. c.) cites under *B. montana*, *Cluytia montana* Roxb. and *B. montana* Roxb.; he also refers to a specimen collected by Klein in Herb. Willdenow, which I have not seen. He further refers to a specimen of Griffith's (no. 4887) from Bengal, this last, however, is typical *B. verrucosa* as stated above. Beddome's *B. montana* is doubtful. I have seen no specimen and his description leaves it uncertain. Brandis (l. c.) evidently alludes to *B. verrucosa* and he correctly describes the fruit as ovoid-oblong. Gamble (l. c.) also apparently refers to *B. verrucosa*.

III. Bridelia Hamiltoniana Wall. (Fl. Br. Ind. v. 271).

Prain (Bengal Pl. p. 927) thought that he recognized Roxburgh's *B. montana* in *B. Hamiltoniana* Wall., but he also includes our *B. verrucosa* (var. *communis*, l. c. p. 928). The identification, omitting the variety, is probably correct, though the identity with Roxburgh's figure and description is far from absolute.

The type of *B. Hamiltoniana* is Wallich's No. 7881, collected by Hamilton and marked by him "*Bridelia montana*, Mungger, 3rd Sept., 1811" (Mungger is now known as Monghir, or Monghyr). This plant has leaves 2–2·7″ long, narrowly elliptic to broadly elliptic-obovate, sometimes obtusely acuminate with the blade suddenly contracted into the tip, but not in so marked a manner as in the Concan plant mentioned below. The secondary nerves are 7–9 each side, rarely forked. The twigs and petioles are pubescent and the leaves pubescent or puberulous beneath. Stipules 3–5 mm. long, very narrowly lanceolate when young, becoming filiform when old, persistent and usually reflexed at the flowering axils.

Roxburgh, on the other hand, describes the leaves of his *Cluytia montana* as glabrous and the stipules as "small acute and withering," and they are so drawn. The differences from *B. Hamiltoniana* both in the drawing and the description thus seem at first very great. Hamilton's plant, however, appears to me to be an extreme form of a widely spread species which extends from the Kharakpur Hills in the province of Bihar and Orissa, through the Kaimur Hills in the same province, right through the Central Provinces where it sometimes becomes common along rocky ravines in the hills, thence to the Concan in the Bombay Presidency. There are three easily discriminated varieties:—(*a*) The Bihar plant to which the type belongs= *B. Hamiltoniana* var. *genuina*, Muell. Arg. in DC. Prodr. xv., 2, 501. (*b*) The Central Provinces plant, which I now call var. *Stapfii*. Leaves very variable in shape, but usually rhomboid or obovate with rhomboid base tip obtuse or rounded, secondary nerves usually 6–7 sometimes up to 10 each side, often forked. Twigs and leaf-blade glabrous, but buds, petiole, and stipules often pubescent. This I consider very close to *B. montana*.

(*c*) The Concan plant=*B. Hamiltoniana* var. *glabra* Muell. Arg. (l. c.). This has very characteristic narrowly rhomboid leaves with the blade suddenly contracted below the tip, whole plant usually very glabrous, sec. nerves only 5–6 each side, straight, oblique, but a few forked.

The Concan plant, however, in spite of the distance of its habitat, more closely resembles the Bihar plant than does the Central Provinces variety and Mr. Baker unhesitatingly assigns it to the same species. This, together with a knowledge of the variability of the Central Provinces plant growing, and a consideration of the scanty material of the Concan and Bihar plants, further incline me to consider the Bihar and Concan plants almost certainly, and the Central Provinces plant probably, all varieties of one aggregate species. In favour of this view it may be added that a flowering branch of one of the Concan specimens has puberulous petioles and one or two of the leaves are obovate; Bihar specimens from the Kaimur Hills depart from the type in being glabrous. All three forms have the same characteristic stipules on one or another of the twigs.

At the British Museum is a specimen endorsed by Dryander "Ind. Orient. Roxburgh"; on the front of the sheet is a reference to *Coromandel Plants*, t. 171. Dr. Rendle and Mr. Britten, who kindly looked at the sheet, inform me that this may be taken as a co-type of *B. montana*; this specimen is undoubtedly a form of the aggregate alluded to above. All the forms of this aggregate have indeed been placed under *B. montana* Willd., at the British Museum and all under *B. Hamiltoniana* Wall. at Kew! This specimen, which appears to be the only one from Roxburgh's region, whence it may be assumed to have come, except perhaps that of Klein, requires to be more minutely described.

The leaves are mostly oblanceolate-rhomboid or narrowly obovate, most of the secondary nerves are sub-furcate; stipules 3 mm. long, the lowest filiform, but the youngest more linear and therefore more approximating to, but not agreeing with, those shown in Roxburgh's drawing. The specimen does not very closely resemble the drawing, but the main differences between the drawing and the specimen may also, except in the case of the stipules, be found between the drawing and Roxburgh's description! Although the drawing only shows a single lowest leaf somewhat obovate, the description says "leaves long obovate" and in another place "leaves obovate or wedge-formed" as in the Central Provinces plant; but all the shapes of the leaves figured could, I believe, be found in the Central Provinces plant. There is at first apparently an important difference in the female disc. This is figured as embracing the ovary and reaching three-fourths of the way up and is crenate; but it is described as exactly as in *Cluytia* (= *Cleistanthus*) *patula*. In *C. patula*, however, the female disc is cupular and deeply lobed. In the Central Provinces plant the disc is cupular and lobed, but in some very young flowers I have found it more closed and crenate as in the figure. The female flower of Wallich's *B. Hamiltoniana* I have not dissected, being unwilling to mutilate a type-specimen. The stipules only remain as an important difference, but these are deciduous on some twigs in our specimens, and the youngest, as said above, sometimes approach more nearly to Roxburgh's figure; moreover, Roxburgh employs the term 'withering' not 'falling' (as in *Cluytia collina*) or 'caducous' (as in *B. crenulata*) and the possibility of bad drawing has also to be taken into account as to shape. Finally, Roxburgh's plant cannot have been very rare, as he speaks of it as occurring in both the mountains and the lowlands, and it bears a vernacular name; it would be strange if such a species had never been collected since. I think we should take the name of *B. montana* for the Central Provinces plant at least until further material shows us to be wrong, and that *B. Hamiltoniana* and the Concan plant should be looked upon as separate species or varieties according to the views of individual botanists.

The following is a summary of the conclusions arrived at:—

Bridelia montana Hook. f. is not *B. montana* Willd., but is a mixture of this and another species called by me *B. verrucosa*.

Bridelia montana Willd. is a widely distributed species. including the following varities:—

Var. *Hamiltoniana* = *B. Hamiltoniana* Wall. in Fl. Br. Ind. (in part). Habitat—Karakpur Hills with a glabrous form in the Kaimur Hills, both in the province of Bihar and Orissa.

Var. *glabra* = *B. Hamiltoniana* var. *glabra* Muell. Arg. = *B. Hamiltoniana* in Fl. Br. Ind. (remaining part). Habitat—Concan, Bombay Presidency.

Var. *Stapfii*, var. nov. Habitat—Sambalpur district in province of Bihar and Orissa and Central Provinces.

Of these three varieties the first two may perhaps form one species as defined in the Prodromus and Fl. Br. Ind. and the third another.

IV. Diagnoses of new Forms named above.

Bridelia verrucosa, sp. nov.

B. montana Brandis, Forest Fl. 450 (1874) exc. synon.; Hook. f. Fl. Br. Ind. v. 269 in part (forma 2); non Willd.

A *B. retusa* Spreng. foliorum forma, inflorescentia nunquam spicata; a *B. montana* Willd., foliorum magnitudine nervisque lateralibus; ab utraque inflorescentiæ squamis magnis aliisque characteribus facile distinguenda,

Bridelia montana var. Stapfii, var. nov.

A *B. montana* typica (quam descripta vel depicta) nervis lateralibus pluribus magis furcatis stipularum forma differt. A exemplo in Mus. Brit. foliis magis obovatis subtus glaucis nervis lateralibus pluribus differt.

I have to express my thanks to Dr. Stapf at Kew and to Dr. Rendle, Mr. Britten, and Mr. Baker at the British Museum for kindly giving me much help. I should state, however, that Dr. Stapf does not share my conclusions except in the case of *B. verrucosa.* He would regard my three varieties of *B. montana* as three separate species, all distinct from *B. montana* of Willdenow.

MYCETOZOA ON THE MIDLAND PLATEAU.

By W. T. Elliott, D.D.S., F.L.S.

In compiling either a local fauna or flora there are considerations which might be noted other than a bare record of species. Geographical distribution usually has been considered from areas that are artificially marked out, such as counties. Horizontal range is but a part of the distribution; it is vertical range upon which climate so much depends, as well as geological conditions, that exercise influences viewed from the ecological standpoint. Therefore this list of records of Mycetozoa embraces those found in the three counties, of Warwickshire, Worcestershire, and Staffordshire, within a radius of about fifteen miles of the city of Birmingham, and this covers a large part of what is known as the Midland Plateau. If the whole extent of these three counties were under consideration, both the geological and geographical variations would be very diverse, for the Midland Plateau forms a distinguishable natural area, which varies in altitude from below the 300 feet to just beyond the 1000 feet contour-line. The variations in elevation in the area under consideration lie between 130 and 1000 feet.

Geologically, the stratum is mainly triassic, but in the south there is an outcrop of lias formation, and in the north-west carboniferous strata cover much of the Staffordshire area known as the Black Country. In addition, there exist exposures of Palæozoic rocks in more or less isolated patches of varying area. A large part of this country also is covered with the detritus of the glacial epoch, and it is upon the character of this that much of the arboreal growth depends.

The principal gathering-grounds were:

For Warwickshire—Sutton Park, Marston Green, Earlswood, and Mockley Wood:

For Worcestershire—Malvern, Witley Park, Wyre Forest, and Hop Dingle Wood:

For Staffordshire—Hamstead Park.

In the following table, there are 121 species and varieties—89 for Warwickshire, 100 for Worcestershire, and 63 for Staffordshire: this compares favourably with about 148 species and varieties that have been recorded from Yorkshire, which has a very much larger area.

The following species and varieties are recorded for the first time for Warwickshire: *Badhamia foliicola* Lister; *Physarum viride* Pers.; *P. viride* v. *aurantium* Lister, *P. bitectum* Lister, *P. virescens* var. *nitens* Lister; *Fuligo cinerea* Morg.; *Diderma deplanatum* Lister, *D. radiatum* Lister; *Stemonitis splendens* var. *flaccida* Lister; *Comatricha pulchella* Rost., *C. elegans* Lister, *C. laxa* Rost.; *Lamproderma violaceum* Rost.; *Enteridium olivaceum* Ehr.; *Trichia scabra* Rost.; *Arcyria incarnata* var. *fulgens* Lister, *A. nomiformis* Rost.; *Perichæna corticalis* var. *affinis* Lister, *P. vermicularis* Rost.: these were taken by myself.

For Worcestershire: *Physarum bitectum* Lister; *Diachæa subsessilis* Peck; *Stemonitis splendens* var. *flaccida* Lister; *Lamproderma arcyrionema* Rost., *L. atrosporum* v. *anglicum* Lister; *Prototrichia metallica* Mass.: these were taken by Mr. E. Brazier.

This gives an additional 25 species and varieties since the publication of previous records.

In the following table, G.=those species given in the *Fauna of the Midland Plateau* by Mr. W. B. Grove (1910); L.=those given in Lister's *Monograph* (1911); H.=those mentioned by Mr. N. G. Hadden in his list for Worcestershire (1914); B.=those collected by Mr. E. Brazier in Worcestershire; E.=those taken by myself.

	Warwickshire.	Worcestershire.	Staffordshire.
Ceratiomyxa fruticulosa McBr.	E., G.	H., B.	G.
Badhamia hyalina Berk.=capsulifera Berk.	G.	H.	......
B. utricularis Berk.	E., G.	H., G.	G.
B. nitens Berk.	E., G.	......	......
B. macrocarpa Rost.	......	H.	G., L.
B. panicea Rost.	E., G.	H., G., B.	G., E.
B. foliicola Lister	E.	H.	......
Physarum psittacinum Dittm.	G.	......	G.
P. viride Pers.	E.	H., B., E.	......
P. viride v. incanum Lister	E., G.	......	......
P. viride v. aurantium Lister	E.	H.	......
P. nutans Pers.	E., G.	E., G., H., B.	G.
P. nutans v. leucopheum Lister	E., G.	H., B., E.	G., L.
P. compressum A. & S.	E., G., L.	H., B., E.	G.
P. bitectum Lister	E.	B.	......
P. lateritium Morg.	......	......	G.

	Warwickshire.	Worcestershire.	Staffordshire.
Physarum cinereum Pers.	E., G.	G., H.	G.
P. vernum Somm.	......	H.	......
P. sinuosum Weinm.	E., G.	G., H.	G.
P. contextum Pers.	E., G., L.	H.	G.
P. virescens Dittm.	E., G.	......	......
P. virescens v. nitens Lister	E.	......	......
P. rubiginosum Fr.	......	......	G.
Fuligo septica Gmel.	E., G.	G., H., B.	......
F. cinerea Morg.	E.	......	......
Craterium minutum Fr.	E., G.	E., G., H., B.	G.
C. leucocephalum Dittm.	E., G.	E., G., H., B.	G.
C. aureum Rost.	......	H.	......
Leocarpus fragilis Rost.	E., G.	E., H., B.	G.
Diderma spumaroides Fr.	......	H.	G.
D. hemisphæricum Hornem.	G.	H., B.	......
D. effusum Morg.	......	H.	......
D. niveum McBr.	G.	......	......
D. deplanatum Lister	E.	......	......
D. radiatum Lister	E.	G., H., B.	......
D. Trevelyani Fr.	......	H.	......
D. floriforme Pers.	......	H., L.	......
Diachæa leucopoda Rost.	G.	H.	G., L.
D. subsessilis Peck	......	B.	......
Didymium difforme Duby	E., G.	H., B.	G.
D. complanatum Rost.	G.	H.	......
D. clavus Rost.	E., G.	G., H.	......
D. melanospermum McBr.	E., G.	G., H., B., E.	G.
D. nigripes Fr.	E., G.	G., H., E.	......
D. nigripes v. xanthopus Lister	E., G.	H.	L.
D. squamulosum Fr.	E., G.	G., H., B.	G.
D. anellus Morg.	......	H.	......
Mucilago spongiosa Morg.	E., G.	G., H.	......
Colloderma oculatum G. Lister	......	H.	......
Stemonitis fusca Roth.	E., G.	G., H., B.	G.
S. fusca v. flaccida Lister	......	H.	......
S. fusca v. confluens Lister	G.	......	G.
S. splendens v. flaccida Lister	E.	B.	......
S. herbatica Peck	......	H., L.	......
S. flavogenita Jahn	E., G.	H., B.	G.
S. ferruginea Ehr.	......	E., B.	G., L.
Comatricha nigra Schr.	E., G.	G., H., B.	G.
C. nigra v. alta Lister	......	......	L.
C. pulchella Rost.	E.	H.	......
C. pulchella v. fusca Lister	......	H.	......
C. pulchella v. tenerrima Lister	......	H.	......
C. typhoides Rost.	E., G.	G., H. B.,	G.
C. typhoides v. heterospora Rex	......	H.	......
C. rubens Lister	......	H.	......
C. elegans Lister	E.	......	......
C. lurida Lister	......	H., B.	......
C. laxa Rost.	E.	H., B.	......
Enerthenema papillatum Rost.	E., G.	H., B.	G.
Lamproderma scintillans Morg.	G.	G., H.	G.
L. columbinum Rost.	......	H.	......
L. violaceum Rost.	E.	H.	......

	Warwickshire.	Worcestershire.	Staffordshire.
Lamproderma violaceum v. carestiæ Lister	......	H.	......
L. atrosporum Meyl. v. anglicum Lister & Howard	......	B.	......
L. arcyrionema Rost.	......	B.	......
Amaurochæte fuliginosa McBr.	......	H.	......
Brefeldia maxima Rost.	E., G., L.	H.	G.
Cribraria argillacea Pers.	G., L.	H., B.	G.
C. rufa Rost.	G.	H.	......
C. aurantiaca Schr.	G.	G., H.	......
Dictydium cancellatum McBr.	E., G.	H., B.	G.
D. cancellatum v. fuscum Lister	......	H.	......
Licea flexuosa Pers.	......	H.	......
Tubifera ferruginosa Gmel.	G.	G., H., B.	G.
Dictydiæthalium plumbeum Rost.	E., G.	H.	G.
Enteridium olivaceum Ehr.	E.	H., E.	......
Reticularia lycoperdon Bull.	E., G.	G., H., B., E.	G.
Liceopsis lobata Torrend	......	G., H.	......
Trichia favoginea Pers.	G., L.	......	......
T. affinis de Bary	E., G.	G., H., B., E.	......
T. persimilis Karst.	E., G., L.	G., H., B., E.	G.
T. scabra Rost.	E.	H., B.	G., L.
T. varia Pers.	E., G.	G., H.. B., E.	G.
T. contorta Rost.	E., G.	H., E.	......
T. contorta v. inconspicua Lister	......	......	G.
T. lutescens Lister	......	H.	......
T. decipiens McBr.	E., G.	G., H., B.	G.
T. Botrytis Pers.	E., G.	H., B.	G.
T. Botrytis v. munda Lister	......	H.	......
Oligonema nitens Rost.	G.	......	G., L.
Hemitrichia vesparium McBr.	E., G., L.	G., H.	G.
H. intorta Lister	E., L.	......	G.
H. leiotrichia Lister	G.	H.	G.
H. clavata Rost.	E., G.	H., B.	G., L.
H. Karstenii Lister	......	......	G., L.
Arcyria ferruginea Saut.	E., G.	H., B.	G., L.
A. ferruginea v. heterotrichia Torrend	G.	......	......
A. cinerea Pers.	E., G.	G.,H.,B..,L.,E.	G.
A. pomiformis Rost.	E.	......	......
A. denudata Sheld.	E., G.	G., H., B.	G.
A. incarnata Pers.	E., G., L.	G., H., B.	G.
A. incarnata v. fulgens Lister	E.	......	L.
A. nutans Grev.	E., G.	H., B.	G.
A. Œrstedtii Rost.	G., L.	......	......
Lachnobolus congestus Lister	E., G.	......	G., L.
Perichæna depressa Libert	E., G.	H., B.	G.
P. corticalis Rost.	E., G.	H., B.	G.
P. corticalis v. affinis Lister	E.	......	......
P. vermicularis Rost.	E.	H., L.	......
Margarita metallica Lister	E., G., L.	G., H., B.	G.
Dianema depressum Lister	G. L.	H., B.	......
D. Harveyi Rex	......	H.	......
Prototrichia metallica Mass.	G.	B.	G., L.
Lycogala epidendrum Fr.	E., G.	G., H., B., E.	G.

THE LICHEN LIFE-CYCLE.

By A. H. Church.

(Continued from p. 170.)

V. The Case of the Laboulbeniaceæ.

The remarkable forms of the Laboulbeniaceæ are described more particularly in the classical monographs of Thaxter[1], and are now enumerated to about 50 genera and 600 species; though they are still little known in complete cytology, and are largely lacking in interpretation. These diminutive fungi, holoparasitic on insects (as beetles and flies), reduced to a minimum somatic expression, being rarely over a millimetre in height, as the merest vestigial pulvinate types of thallus, present a complexity of fertilization-mechanism which, in some respects, takes them even far beyond the horizon of the Florideæ of the sea. Yet, fundamentally, they agree in a primary scheme of a two-phase life-cycle, fertilization *in situ*, a diploid asexual sporangiate phase bearing the familiar 8 (4)-spored sporangia, hence termed 'asci' (commonly reducing to the limit of 4 spores, and these biseptate), so that the family is still conventionally included within the great Fungus-series of the Ascomycetes[2].

The sporophyte generation is reduced to the barest minimum of 2–3 supporting cells, from which asci are budded off (only in an extreme case as many as 30), and the asci present the familiar scheme of meiosis, followed less frequently (*Compsomyces*, *Moschomyces*) by one mitosis to give a series of 8 ascospores. The last mitosis is commonly suppressed, giving the limit of one tetrad; and the septation of the spore-origins may follow on after the laying-down of the spore-coat, giving the case of the septate spore with a limiting expression commonly obtaining as the biseptate condition. Spore-discharge is graded by successive growth of asci, and controlled by close-fitting 'perithecial' mechanism with narrow ostiole, which often represents the greater part of the parental gametophyte, to such an extent that the significance of other portions of the soma has been obscured by the use of the expression 'receptacle'[3]. In these respects the Ascomycete-relations of the Laboulbeniaceæ appear beyond dispute; they express the miniature vestiges of a cellular perithecial construction, again the more interesting as the perithecium with its ostiole is in functional operation before fertilization and the production of the asexual spore-output it was originally designed to control. Exactly as in the case of the higher Florideæ, the wall of the cystocarp may be precociously conspicuous before fertilization (*cf.* 'Ceramidia' of *Polysiphonia*, *Corallina*). The hymenial organization is wanting[4]; there are no parental paraphyses, and the asci

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[1] Thaxter (1896) Monograph of Laboulbeniaceæ, I; (1908) II. Faull (1911) Annals of Botany, p. 649: (1912) p. 325. Guilliermond (1912) Rei Progressus, p. 487.

[2] Strasburger (Eng. Trans. 1912) p. 388: Faull (1912) p. 344.

[3] Thaxter (1898) Monograph I, p. 206.

[4] Thaxter (1898) Monograph II, p. 231, t. 37; distinctly suggested in *Polyascomyces* with exceptional number (30) of ascogenous cells.

give a continuous output in the manner of the carposporangia of *Polysiphonia* from a sporophyte-soma, which, similarly, no longer presents any discernible differentiation of tissues or parts, but merely passes on into the crop of asexual spores retained for the dispersal function the food-supplies provided by the gametophyte—in this case itself a mere go-between for the nutriment taken directly from the host. Admitting the Ascomycete-nature of these organisms, so far as the so-called ascus may be any real guide to phyletic descent, the first striking feature of the group is the total lack of mycelial organization in terms of the familiar fungus-hyphæ. The plants, absorbing from animal hosts with considerable nitrogenous waste, show little polysaccharide, and their cell-membranes are preponderatingly 'chitinous,' as those of the insect[1]. But though wholly destitute of the hyphæ of more massive fungi associated with the skeletal tissues of their algal prototypes, the Laboulbenias, on the other hand, retain a filamentous organization, which is not only the obvious vestigial expression of the original filamentous ramalia the saprophytic Ascomycetes have lost, but it is pre-eminently that characteristic of modern Florideæ[2]; being based, that is to say, on uniseriate filaments of cells with single nuclei and the familiar primary 'Floridean pits,' together with similar general formation of plasmic connections by 'secondary pits'[3]. Growth of the filaments may be both apical and intercalary[4], and ramification is often beautifully precise[5]; unilateral or bilateral, in the manner of *Callithamnion* and *Antithamnion*, or *Sphacelaria*[6]; subdichotomous tufted systems of ramuli[7], and beautifully bilateral frond-expressions[8], in all the familiar constructions of the elementary filamentous soma of the benthic phase of the sea, recalling in individual cases the habit of smaller Callithamnions, Antithamnions, the apices of Ceramiums[9], and the characteristic symmetrical schemes of segmentation of *Delesseria*[10]. In other cases multiseptation to more massive axes obtains to an extent which recalls the simpler forms and juvenile phases of the Phæophyceæ[11]. In fact, Thaxter's figures seen with the eye of an algologist, rather than that of a mycologist, become a compendium of diminutive algal forms; the limit being reached possibly in the wonderful *Zodiomyces vorticellaris*[12], with unmistakably the multiseptate pseudo-parenchymatous main axis and the fringed funnel of the young *Zanardinia*[13], or a replica of juvenile phases of *Cutleria*

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[1] Also taking the material giving the debris-pigments of the insect-membranes where these are available.

[2] Thaxter, *loc. cit.*; for *Chantransia*-forms *cf.* tt. 14, 15, 16, 53, 55.

[3] Thaxter, *loc. cit.*; t. 2, figs. 16, 17: Faull (1912) Ann. Bot.

[4] Thaxter (1908) p. 224.

[5] *Loc. cit.* tt. 12, 18, 39 *Herpomyces*, 44 *Rhacomyces*.

[6] *Loc. cit.* tt. 4 *Enarthromyces*, 12 *Rhacomyces*, 29 *Dimeromyces*.

[7] *Loc. cit.* (1908) tt. 64, 65.

[8] *Loc. cit. Dichomyces*, tt. 30, 32, 33; (1896), t. 8.

[9] *Loc. cit.* t. 20.

[10] *Loc. cit.* t. 8, *Dichomyces*, tt. 30–33.

[11] *Ceratomyces mirabilis*, t. 24; tt. 68, 69, 70.

[12] t. 23 (1896) p. 372, a more definitely aquatic form, 1 mm.

[13] Yamanouchi (1913) Bot. Gazette, 56, p. 28.

adspersa[1], with even the additional faculty for throwing out basal disc-lobes of approved disc-soma habit. Earlier stages of development also figured[2] are approximately identical with the ontogeny of the multiseptate cable-type of *Chorda Filum*[3]. The relation of these somatic data to the commonplace form-factors of marine algæ is so striking that it is beyond equivocation, once it is grasped that there must be a cause for the initiation of every such detail and variant in somatic constitution; and, again, that the effective cause must be the same in all groups. So that when the marine origin of the sea-weeds of the sea is accepted, the immediate marine origin of the Laboulbeniaceæ is beyond question. As Lichens exemplify all the various form-factors of the massive algal somata of the sea[4], so the Laboulbeniaceæ present indications of all the corresponding form-factors of the older filamentous soma[5]; and. again, *these and no other*. The problem presented to the mycologist, in the latter case, is identically the same as that offered to the lichenologist in the former. If these form-factors can be evolved *de novo* in a parasitic fungus-race of the land, the initial stimuli to which they are the response require to be demonstrated, as also their effective benefit. One gets no further by concealing the details of construction under terms of 'appendages of reproductive receptacles'[6], or postulating 'opportunities for eccentricity of form'[7]. Nor are the beautifully segmented little bilateral frond-systems of *Dichomyces*[8] to be explained as teleologically adapted to lie flat against the body of the host. The alternative deduction that identity of form-factor, however obscure or vestigial in individual cases, implies a common origin in the sea is scientifically more satisfactory; as again indicating the heritable continuity of morphological detail when once established by natural selection, even from a horizon that may be expressed by thousands of millions of years ago. The conception of a successful mutation, that once gained may be constant for ever (De Vries), is the nearest thing to it in modern botany. Hence, while the marine ancestry of the somata of the larger saprophytic fungi of the land may be traced in the retention of skeletal hyphæ of larger algal growth-forms, and evidence of older cortical ramalia-systems may be traced in more conservative reproductive organs,—the Laboulbeniaceæ serve to mark the extent to which a similar high-grade soma may be reduced to the earliest *juvenile expressions* of similar marine progression, as these present precocious reproductive capacity[9]. Just as, in fact, the prothallus of a common Fern, and still more that of Rhizocarps, may show how precociously and efficiently sexual mechanism may be associated with limiting terms of early embryology in a soma, itself the limiting decadent expression of the morphological deterioration of a high-grade plant-form with the stem, leaf, and root of the sporophyte-phase[1].

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[1] Sauvageau (1899) Ann. Sci. Nat. p. 325.

[2] t. 23 (1896) p. 372, a more definitely aquatic form, 1 mm.

[3] Reinke (1892) Atlas, t. 28; Batters (1895) Ann. Bot. p. 307, *Buffhamia*.

[4] 'The Lichen Symbiosis,' Journ. Bot. 1920, p. 265.

[5] 'The Phæophycean Soma,' Bot. Memoirs, 1920, p. 24.

[6] Thaxter (1896) Monograph, pp. 206, 208, 'of systematic value only.'

[7] Thaxter, *loc. cit.* p. 198.

[8] Thaxter (1908), p. 226.

[9] Even De Bary missed the significance of the 'appendage' of Peyritsch. although noting that it was produced from the apical unit of the biseptate spore in *Stigmatomyces* (De Bary, 1887, Eng. Trans. p. 264); and Faull (1912, p. 330) seems struck by the fact that the 'appendages' do not show signs of decay, but are well-nourished even on old plants!

Having accepted the connection of the ascus of the Laboulbeniaceæ with the asexual phase of the general Ascomycete series, and demonstrated the identity of types of Laboulbenian somata, and their relation to early stages of Pre-Floridean or Para-Phæophycean marine origin, it is now interesting to compare the details of the sexual processes with those of the Florideæ on the one hand, and with those of Lichen Fungi on the other; since spermatogamy is not only apparently still dominant in the group, but it is specialized to an extent so much in advance of the Florideæ that it may cover the still somewhat vague details of the Lichen-mechanism. As already noted, the asexual generation is reduced to the limit of a few asci contained within a 'perithecial' investment of gametophyte tissue, constructed usually of a minimum number of cell-units, functional before fertilization, and controlling the protection, nutrition, and spore-output of the ascosporophyte by a narrow ostiole, exactly in the manner of the cellular procarpial branch of *Polysiphonia*, rather than that of a Pyrenomycete hyphal perithecium. It thus presents the morphological expression of a distinct 'procarpial' branch of the parental soma, often markedly differentiated from the somatic ramuli when the thallus retains any definite mass or cellular structure (*Zodiomyces*). While the asci are normal for a Pre-Floridean type of unilocular sporangium, special interest centres in the sexual organs and mechanism, so far unique in the plant-kingdom, though comparable and clearly analogous with conditions of spermatogamy in both Lichen Fungi and Florideæ, and obviously the outcome of similar environment, even if always divergent in details of morphological elaboration. Spermatogamy attains its limiting character; fertilization is restricted to an aqueous medium; but a drop may suffice, and the minimum plankton-rate of a drop, as opposed to the reef-pool habit of the Floridean, bears comparison with the antherozoid output of a Fern-prothallus, giving large motile flagellated zoïds at an effective plankton-rate in the plankton-phase of a dew-drop. Spermatia are budded off in profusion from antheridial ramuli, as tufted subdichotomous growths[2], in the form of conidio-spermatia[3], or again ejected as minute apparently naked protoplasts within a protective tube-membrane. In extreme cases special protective 'antheridial receptacles'[4] express a xerophytic adaptation, fundamentally analogous with the antheridial receptacle of the transmigrant *Chara*[5]. In the first case the Laboulbeniaceæ resemble the Lichen-type; in the last they are more advanced than the most specialized Floridean[6]. Since

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[1] 'Thalassiophyta,' Bot. Mem. 3, p. 81.

[2] Thaxter (1896), t. 2, fig. 7.

[3] *Loc. cit.* t. 23, *Zodiomyces.*

[4] *Loc. cit.* t. 4, fig. 16; t. 7, figs. 9, 22.

[5] 'Thalassiophyta,' Bot. Mem. 3, p. 15.

[6] Cf. Yamanouchi for *Polysiphonia*, Bot. Gazette (1906), 42. p. 410; also *Graciliaria.*

meiosis undoubtedly normally obtains in the ascus [1], the sexual plants are presumably haploid. Fertilization of the female gamete, though not yet traced in full cytological detail, is more complex than in the Floridean. The carpogonial branch is remarkably constant, as again indicating the retention of some very anciently established mechanism. The carpogonial cell is a uninucleated little-differentiated basal unit, with superposed 'trichophoric cell' similarly uninucleate. This in turn bears the so-called 'trichogyne,' as a mere hair-extension [2], or as a copiously branched system of uniseriate ramuli, the end-units of which may be spirally coiled [3], giving a plumose effect for the collection of passive spermatia, much in the manner of the plumose pollen-collecting stigma of a grass, and similarly devoted to the retention of one fertilizing unit. The essential point is that in process of reaching the female nucleus, the male nucleus must inevitably travel *via* a sequence of cell-segments of the trichogyne-system, when this is multicellular, and in all cases through the trichophoric cell, opening up the primary pit-connections in its passage, in a manner which recalls the *post-sexual* migration of the zygote-nucleus of higher Florideæ, but is here *pre-sexual* to an extent which does not obtain in any known algal form; though it is undoubtedly also the mechanism of sexual approximation in the Lichen. Precise cytological details may be still wanting for the Lichen-type; but the case of *Collema* (Baur) and *Physcia* (Darbishire) is clearly but a variant on the mechanism of *Laboulbenia* (Faull) [4]; again, by no means exactly homologous, but directly analogous as spermatogamy prevails, and an indication that the same biological progression has been followed through successive stages in plant-phyla of presumably widely divergent descent. The analogy is the expression of parallel adaptation to similar conditions of environment, and is not to be taken as indicative of any direct 'affinity.'

The Laboulbeniaceæ, so unlike the saprophytic Ascomycetes of the land, and somatically clearly of marine origin, thus serve to complete the halting tale of the Lichen-Fungi, and so bridge the gap of the otherwise inexplicable vestigial uniseriate procarp. There can be no reasonable doubt that the convergence of these remarkable and residual groups of heterotrophic plant-organism is the expression of a common origin in the sea, following the opportunities of tide-pool formations for a restricted plankton-rate in cheap spermatia, the wholly protected and controlled production of female gametes without wastage, and the graded output of asexual spores capable of withstanding the desiccation of subaerial translation. The larger group of Ascomycetes in the narrower sense, adopting methods of saprophytic nutrition on decaying remains of vegetation. passes in the limit to active holoparasitism on the photosynthetic tissues of the foliage-leaves of higher land-plants. The Lichens survive in virtue of their association with intrusive algal scums in ill-aerated shore-ponds. The Laboulbeniaceæ, having passed through the stages of saprophytism on dead organisms to obligate parasitism on the smaller

[1] Faull (1911) Ann. Bot. p. 652.

[2] Thaxter (1896), *Zodiomyces*, t. 23, fig. 16.

[3] *Loc. cit.* t. 2, fig. 5; t. 21, fig. 15; Faull (1912), fig. 31.

[4] Faull (1911), p. 651.

forms of animal life of the same ponds, culminate on the bodies of higher modern insects which may attain wholly subaerial habits. In contrast with the minimum soma of the Laboulbeniaceæ, reduced to vestigial juvenile phases, as it becomes regulated to the short life-period of the insect-host and the time-factors of insect-life[1], the Lichen retains form-factors and the relics of tissue-differentiation of an equally high-grade and massive series of plant-forms; and the story of one divergent group amplifies that of the other, to the extent that the two together open up vistas of older algal races of the sea, beyond the confines of the few widely divergent and residual series seen in modern seas as Brown and Red seaweeds. Similarly, the reproductive story of the Lichen does but cover the same ground, and the same sequence of biological progression that has been already outlined from consideration of the form-factors of the vegetative soma alone. *In all cases the algal outlook is essential*, and is now seen to be the only one capable of binding the whole story into one unified scheme of progression; as the outlook of the mycologist, systematist, or collector, tends merely to place these vestigial races of an older world in watertight compartments, with no direct connection with each other, as a retention practically of an older outlook of special creations.

(To be continued.)

NEW OR RARE BRITISH HEPATICS.

By William Edward Nicholson, F.L.S.

Riccia Huebeneriana Lindenb. During the warm sunny autumn of 1919, when the mud of the large pond at Horsted Keynes, Sussex, had been uncovered for a long time, I gathered on some of the more exposed parts of the mud, where I had frequently found *Riccia pseudo-Frostii* Schiffn., several rosettes of a deep violet *Riccia*, which I am unable to distinguish from *R. Huebeneriana*. On cutting transverse sections of the frond, I found these agreed closely with the figures of the frond-section of this species as given by Karl Mueller (*Die Lebermoose*, 1st Abl. p. 206). The rosettes are a little more compact and have shorter branches than in my Continental specimens, but the differences are not material, and I do not think that there can be any question as to the identity of the plant. In spite, however, of rather striking differences between characteristic specimens of *R. Huebeneriana* and *R. pseudo-Frostii*, there are perhaps reasons for questioning whether they are really specifically distinct. Schiffner first separated *R. pseudo-Frostii* only as a variety of *R. Huebeneriana*, and finally elevated it to the rank of a distinct species, principally on account of the larger size, the different appearance of the much greener rosettes, which are only faintly tinged with violet, and the winged thallus, as seen in transverse section. Certainly these characters, especially that drawn from the section of the thallus, which is generally one of the most trustworthy in this difficult genus, appear to warrant Schiffner's later opinion, but on careful search in the field these characters are found to be subject to rather wide variations. The green colour of the plant appears to vary directly in accordance with the amount of sunshine which it receives, and this variation proves on cultivation to take place very rapidly; while the larger size and the swollen growth of the upper portion of the thallus, which gives the appearance of wings, seems to be directly attributable to the wetter, more shaded situations in which the variety generally grows.

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[1] Thaxter (1896), p. 240, cf. *Stigmatomyces* on flies, mature in 10–14 days; the time-factor thus giving the clue to the arrest of the soma at a 'juvenile stage.'

CEPHALOZIA SPINIFLORA Schffn. In "Cephalozia-Studien" (*Hedwigia*, Bd. liv. 1914, pp. 311–327) Schiffner publishes the description of a new species of *Cephalozia*, of the *C. catenulata* (Hüb.) Spruce group, under the above name. The new species differs from *C. macrostachya* Kaal., its nearest ally, in the heteroicous inflorescence, the rather larger and generally more incrassate cells, the very long andrœcia with more spinous-dentate bracts, the more spinous-dentate perichætial bracts, and in the perianth being usually split to the base with its mouth longly-toothed, the teeth themselves being toothed on their margins. The plant is normally dioicous, but occasionally paroicous or synoicous inflorescences can be found, the latter being a rare condition in hepatics and probably unique in *Cephalozia*. The heteroicous inflorescence is rare, and might be regarded as a merely abnormal condition, were it not found to exist in the plant from widely separated localities.

Forms of the *C. catenulata* group are well represented in Sussex, and on revising my plants in the light of Schiffner's publication, I made certain that a plant that I gathered on Ambersham Common and sent to Schiffner, and which is published as No. 549 of his Hep. Eur. Exs. as *C. macrostachya* Kaal., belonged to the new species. All the characters above mentioned were present, and I had often had qualms as to whether this plant were really identical with the true *C. macrostachya* Kaal., of which the author kindly sent me an original specimen from the island of Ramholmen, Norway, as it materially differed from this and also from other undoubted specimens of *C. macrostachya* from other parts of Sussex and elsewhere. This view is corroborated by Karl Mueller (*op. cit.* 2nd Abl. p. 778), where he cites the Ambersham plant as belonging to this species, which he reduces to the rank of a variety of *C. macrostachya*. The question of according specific rank to many of the puzzling forms of this difficult genus must always largely remain a personal one, but I think that Dr. Schiffner has shown good reasons for regarding *C. spiniflora* as a species of equal validity with *C. macrostachya*, which might itself be regarded as a marsh variety of a polymorphic *C. catenulata*. Figures 4 to 7 of *C. macrostachya* by Mr. Jameson in Macvicar's *Student's Handbook of British Hepatics* relate, no doubt, to *C. spiniflora*.

CEPHALOZIELLA ELACHISTA (Jack) Schiffn., var. SPINIGERA (Lindb.) K. M. For some years past I have from time to time gathered in the bogs of Ashdown Forest a few scattered sterile stems of a small species of *Cephaloziella*, which I felt sure must belong to this species, and the proof of the plant's existence with us was fully confirmed in May 1919, when, while botanizing on the forest near Pressridge Warren with Mr. Ll. J. Cocks, we came upon a small tuft of the variety with well-developed perianths. The plant was originally described by Lindberg (Musci Scand. 1879, p. 6) from sterile material from Kemi, Lappmark, as a distinct species under the name of *Cephalozia spinigera* Lindb., which he considered as related to *C. catenulata* (Hueben.), but distinct in the long spiny teeth which spring from near the base of the lobes of the leaves, and are often nearly as long as the lobes themselves. The plant certainly has a very distinct appearance, and the description, which was made from sterile material only, would perhaps justify its being treated as a distinct species. It is curious that it should have been compared with *C. catenulata*, with which it has no close relationship; but according to Arnell and Jensen ("Ueber einige seltene scandinavische Cephalozia-arten," Bot. Notiser, 1908, pp. 9–13), the late Herr Kaalaas seems to have had good reasons for thinking that Lindberg, in 1879, regarded the plant subsequently named by Spruce as *C. leucantha* as the true *C. catenulata* (Hueben.). Arnell and Jensen, in the paper above cited, amplify the original description, and also cite further sterile material from Mora in Dalarne and Hjortesö, Denmark. There are some excellent drawings by Herr Jensen; the authors refer the plant to *C. striatula* Jens. as a variety, laying particular stress on the more or less papillose leaves. Karl Mueller (*op. cit.* Bd. ii. p. 119) criticizes this conclusion, and considers that the plant should be referred as a variety to *C. elachista*. He draws attention to the fact that the leaf-cells are those of that species, and that the papillosity of the leaves in both *C. elachista* and *C. striatula* is very variable. The discovery of perianths on the Ashdown Forest plant tends to confirm this view, which, I understand, Herr Jensen now shares, as the involucral bracts have the long spinous-ciliate, frequently decurved, teeth of *C. elachista*, and the leaf-cells are those of that species, though the cell-walls have a distinct tendency to be thickened and are sometimes slightly papillose. The lower leaves of the fertile stems and the leaves of some sterile stems growing with them agree exactly with those of the sterile form of the variety figured by Herr Jensen. While I agree with the view taken by Mueller, I think that the Ashdown Forest plant tends to show that *C. elachista* and *C. striatulus* are more closely related to one another than would at first seem probable. Plants are occasionally met with on our Sussex bogs which present some difficulty in deciding to which of the two species they belong.

SHORT NOTES.

Æneas MacIntyre (p. 176). The Linnean Society's copy of the original 1829 edition of *A Compendium of the English Flora* has this pencil note on the titlepage: "By Dr. McIntyre F.L.S.," but I do not know who wrote this; it may have been hastily scribbled by David Don, who was then the librarian. The Society's copy of the second edition of 1844 has the word "object" correctly printed, so that the blunder was possibly corrected during printing, and those copies having "boject" are only the earlier issued copies.—B. Daydon Jackson.

The fact of my father having been a pupil at Macintyre's school has made this name a well-remembered one in my family. A prize medal in our possession, the inscription writ in choice Latin, bears the date 1817, which is several years earlier than Mr. Miller Christy mentions in his notice. The school in question was situated not at Stockwell Park, but at Streatham Common, at the north corner of Greyhound Lane. That the venture was unsuccessful is disproved by the fact of the premises having been used for the same purpose until quite recently; a notice board at the entrance claimed the foundation to have occurred as far back as 1787. As further proof, it may be mentioned that the son, also Æneas, was a well-known Q.C. in the sixties and seventies of last century. The old building, which must have been known to Dr. Johnson, whose time it certainly antedates, is now in process of demolition. We know nothing of Macintyre nor of his personal history beyond what is here stated. The inscription on the medal begins: "Palmam qui meruit ferat in ludo literario Æneæ Mackintyre," which one would assume to be the correct spelling of his name, were it not that in the Linnean Society's register and on the title of his book *Etymotonia* he gives it as Macintyre.—SPENCER MOORE.

GENDERS OF GENERIC NAMES (p. 157). I think that the specific and generic names should always agree in gender. By a ridiculous application of a pedantic principle, trees are regarded as feminine. The idea was that they were haunted by dryads or hamadryads; but there is no need for perpetuating the legendary associations by branding the masculine and neuter names of trees as *feminine*, and thus emphasizing "grammatical blunders and false concords which disfigure botanical nomenclature" (Journ. Roy. Hort. Soc. xlv. 220). I prefer *e. g.*—*Populus niger, Pinus silvester, Acer campestre* (Linnæus and others never applied the feminine gender to species of this genus), *Liriodendron chinense* (as Sargent wrote it). In fact there is no consistency in such applications. Nees called the American Sassafras tree *Sassafras officinale* (grammatically correct, and it has never been written otherwise). Therefore why write the barbarism *Taxus baccata* instead of the correct concord *T. baccatus*? It is worse than *Ranunculus acris* (which is not a tree) instead of the academic masculine *R. acer*. Among examples given (p. 157), if *Euonymus* "should be masculine," surely other trees ending in *-us* have similarly concordant claims.—F. N. WILLIAMS.

Silaus silaus (p. 155, l. 11) should be *Silaum silaus*. The genus was published in Miller, Gard. Dict. Abridged (1754); and the combination *Silaum silaus* by Schinz & Thellung in Vierteljahrsschr. Nat. Ges. Zürich, lx. 359 (1915).—T. A. SPRAGUE.

EPIPACTIS VIRIDIFLORA (p. 146). In conformity to the change which Col. Godfery's research has made necessary, our *Helleborine viridiflora* f. *vectensis* and f. *dunensis* (Journ. Bot. 1918, 2) ought now to be transferred to *E. leptochila* Godfery as varieties of that species. We should now like to name them as varieties rather than forms. There is no doubt about the subordinate rank of var. *vectensis*. As to var. *dunensis*, though the habit and the habitat are very distinct, we think it ought not to rank as a species but only as a variety.—T. & T. A. STEPHENSON.

SILENE CONICA L. IN CARMARTHENSHIRE. In 1920 Mr. D. Harmer sent me Carmarthenshire specimens of the above species, gathered on the coast sand-hills in the neighbourhood of *Liparis*

Loeselii Rich. where it is abundant. It occurs with *Liparis* on the sand-dunes in Belgium, Holland, and Normandy, but is not on record for the twenty-three Dutch islands, on six of which *Liparis* is found. Since the publication of *Topographical Botany* (1883), it has been recorded from four English counties. In the *Flora of Dorset* it is named only as a casual, but the Rev. E. F. Linton found it in 1900 on "Sandy heathland pasture near Parkestone." It may be native on Minehead Warren, Somerset. I have it from Kingsley, N. Hants, May 1900 (Miss S. Smyth), and from a fallow field, Send, Guildford, Surrey, 1883 (Mr. Howse). I do not know the grade of Mr. Hilton's Sussex record. The luxuriance of the specimens is no guide as to status; in ordinary seasons in Norfolk, Suffolk, and Kent it is often small and sparsely branched, but in Suffolk in the wet season of 1879, when I gathered *Veronica verna* L. five inches high and much branched, the *Silene* was large and much branched, quite unlike its usual form. Syme (E. Bot. vi. 155 (1866)) gives "1 to 3 inches high" for the *Veronica*.—ARTHUR BENNETT.

SPURLESS COLUMBINE. I have recently seen some curious Columbine flowers in a friend's garden in Herefordshire, where many beautiful forms, both long and short spurred, are grown. On one plant, pink-flowered, there is a complete absence of spurs on the petals; the five petals are exactly like the five sepals, and the whole ten portions of the perianth are laid out perfectly flat at the top of the flower-stalk like a ten-rayed star, producing a most striking and unusual effect. In other plants which I inspected, some pink, some blue, I found a varying number of spurs: one, two, or three petals bearing spurs; four, three, or two with no spurs.—ELEONORA ARMITAGE.

[The monstrosity is not, we think, very uncommon: see Worsdell's *Principles of Plant-Teratology*, ii. 141, where the plant is called *Aquilegia vulgaris* var. *stellata*.—ED. JOURN. BOT.]

MUSK. In *The Garden* for June 25 (p. 322), Mr. H. S. Bartlett, of Shooter's Hill, writes that some plants of Musk potted at the end of last summer, which remained in an old greenhouse during the winter, broke into leaf in April and flowered in May, and filled the greenhouse with scent, recalling that of plants grown in cottage windows in 1862–64. He suggests that the similar conditions may have developed the scent, and adds: "I do not remember Musk being grown out of doors in those days." But about that period the plant was a staple and popular commodity in the small gardens of the pensioners at Chelsea Hospital, who did a considerable trade by selling little bunches of flowers, in which Southernwood was a prominent feature, and small pots, each containing a plant of Musk which was abundantly scented.—JAMES BRITTEN.

BOOK-NOTES, NEWS, ETC.

AT the meeting of the Linnean Society on June 16, Prof. A. H. Reginald Buller gave a discourse "Upon the Ocellus function of the Subsporangial Swelling of *Pilobolus*." He stated that the subsporangial swelling of *Pilobolus* functions, not merely as part of a squirting apparatus, but also as an ocellus, which receives the heliotropic stimulus which causes the stipe to turn the fungus gun toward the light. The swelling is transparent and refracts light, like the bulb of a Florence flask filled with water. Its diameter is always greater than that of the black sporangium which it supports. The sporangiophore of *Pilobolus* appears to be the only ortho-heliotropic plant organ known which takes up its positively heliotropic position owing to the possession of a special light-perceiving cell-structure. *Pilobolus* may well be described as a fungus with an optical sense-organ or simple eye; and, in using its eye for laying its gun, it appears to be unique in the plant world.

At the same meeting was read a paper by Dr. N. Annandale. In order to appreciate the fauna of a small island in the Chilka Lake on the east coast of India, he had found it necessary to study the vegetation. The area of the island is about one-third of a square mile; the rocks are composed of garnet-bearing quartzite which yields an infertile and scanty soil on weathering. The climate is relatively dry. The vegetation consists mainly of trees, shrubs, and perennial creepers, with a great scarcity of herbs, ferns, and epiphytes, and a complete absence of palms, bamboos, screw-pines, and orchids. The genus *Ficus* has the largest number of species (7); the commonest tree is the Nim (*Azadirachta indica*), the commonest shrub *Glycosmis pentaphylla*, and the commonest creeper *Vitis quadrangularis*. Several distinct zones of vegetation can be distinguished. The most interesting is the central thicket, in which *Ficus gibbosa* is rapidly replacing *F. bengalensis*, giving space also, by its less spreading habit, for trees and shrubs of other genera. The peculiarities of the fauna, and especially its deficiencies and generalised character, can be correlated directly with the vegetation. Col. M. J. Godfery read a paper on the fertilisation of *Cephalanthera*, as observed by him in the south of France on *C. rubra*, *C. ensifolia*, and *C. grandiflora*. He holds that *Cephalanthera* is an old genus, existing before *Epipactis* came into being, and was not derived from the latter.

The *Contributions from the U.S. National Herbarium* continue to deal largely with North American grasses. In the latest that have come to hand, Prof. Hitchcock (vol. xxii. part 3) has revisions of four genera of *Paniceæ—Isachne*, *Oplismenus*, *Echinochloa*, and *Chætochloa*; the last replaces *Setaria* on the ground that that name "was applied to a genus of lichens by Acharius and by Michaux at a date earlier than that of its application to the grass genus." The treatment of the species is exhaustive: thus under *Chætochloa geniculata* (Lam.) Millsp. and Chase are nearly four pages of synonyms, and similar space is devoted to the distribution as shown by the collectors' numbers cited. Each species is figured, but no dissections are given. The common defect by which the heads of pages are rendered useless is particularly noticeable here, not even the genera being there indicated. On the same lines Mrs. Agnes Chase (xxii. part 4) describes the North American species of *Pennisetum*, of which one (*P. proliferum*) is new.

The incidental reference (Journ. Bot. 1920, 279) to the essay on Fuchs in Canon Vaughan's *The Music of the Wild Flowers* should have included some account of the copy of his *De Historia Stirpium* in the Winchester Cathedral Library, on which the essay is based.

The woodcuts "have been coloured in the most accurate and artistic manner," and the English names have been added in a sixteenth century hand, which Canon Vaughan thinks was probably that of John Warner, who was Dean of the Cathedral from 1559 until his death in 1564. That Warner was interested in botany may be presumed from the fact that he presented to the Cathedral Library a copy of Ruellius's *De Historia Stirpium* with the inscription "Ex dono Jo. Warneri nuper decani Wynton"; a copy of Dioscorides' *De Materia Medica* also contains Warner's autograph.

The Twenty-seventh Annual Report of the New York Department of Agriculture (vol. ii. part 2), a handsome quarto volume, is devoted to *Notes on Edible Plants*, prepared by Dr. U. P. Hedrick from "a voluminous manuscript consisting of a compilation of existing knowledge on the edible food plants of the world" by E. L. Sturtevant (1842–1898) whose studies in economic botany are well known. The volume, which includes a biography of Sturtevant and an excellent bibliography, is fully documented: we hope to return to it later.

The Report of the Botanical Section of the Somersetshire Archæological and Natural History Society (Proceedings, lxvi.) records "energetic field work by individual members: in spite of a wet summer nearly 500 notes were sent in." A selection of these is published in the Report, the most notable being the addition of *Gentiana campestris* to the county flora. We take the opportunity of saying that the contribution of a guinea towards the deficit of the Journal last year, acknowledged as from the Taunton Natural History Society, should have been credited to the Botanical Section.

The latest issue (April 21) of the *Bulletin of the New York Botanical Garden* is entirely occupied by a classified Guide to the Economic Museum of the Garden, prepared by Dr. H. H. Rusby, its honorary curator. The primary classification of the objects is in accordance with their use as products, but the plants occurring under each heading are arranged in botanical sequence. The "Catalogue of Exhibits," which occupies more than three hundred pages of small print, includes numerous descriptive notes and other information.

The part (vol. vii. part 6) just to hand of Mr. Maiden's *Forest Flora of New South Wales*, while affording ground for congratulation to the author on the steady continuation of a work of undoubted utility during nearly twenty years, and to the Government of the State for producing it at so low a cost—46 quarto pages with 10 plates at the cost of a shilling per part, or 10*s.* per dozen parts—also presents matter for regret in small but important details which it seems hardly credible should for so long have escaped attention. The pages are (save for the number) absolutely devoid of any heading—not even the title of the work appears—and as the descriptions of species often extend over several pages, the inconvenience of consulting the volumes is hardly atoned for by the index. Moreover, while the contents of preceding parts appear on the wrapper of this, its own contents are nowhere indicated!

Under the heading "Buttercups and Daisies" the *Evening News* of June 3 publishes an illustration from an obviously faked photograph, with the legend attached: "Two little Londoners have a happy time gathering wild flowers in Hyde Park"!

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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BRITISH FORMS OF JASIONE MONTANA L.

By H. W. Pugsley, B.A., F.L.S.

The principal object of the present paper is the determination of a very large-headed and beautiful form of *Jasione montana* which I obtained twenty years ago on the sea-cliffs near Ilfracombe. In North Devon, both inland and on the coast, this species is abundant and variable, but the particular form that attracted my attention seemed separable from the smaller-headed plants that I regarded as different forms or states of the specific type. As named varieties of *J. montana* have already been recorded as British, it seems desirable to consider these in conjunction with this Ilfracombe form.

The common sheepsbit, especially as seen in herbaria, generally presents a polymorphic aspect, largely due to variations in habit and hair-clothing. In early summer, when the previous autumn's seedlings first come into flower, the plant, if fairly vigorous, shows a basal rosette of leaves, from which spring a number of suberect, leafy stems, each of which is terminated by a bracteate umbel of flowers borne on a long naked peduncle. In many situations these primary flower-heads quickly disappear, often through browsing animals, and secondary branches, which soon develop flowers, are produced. These in turn are often similarly destroyed and further branching ensues, so that by September the once nearly erect plant has become a decumbent or spreading tuft, irregularly and sometimes intricately branched, and bearing umbels much smaller than those of the primary stems. In these later umbels the bracts are often narrower and more rhomboidal in shape than in the earlier heads, and the aspect of the plant is entirely changed. When the primary stems are not destroyed, very few lateral branches are produced in some forms, while in others these are numerous, springing from the axils of all the upper stem-leaves and sometimes becoming again branched. In the case of plants growing on maritime sands, this varied branching is frequently combined with a more or less prostrate habit, but quite erect forms may be found in these situations. Occasionally, especially in the variety *littoralis*, the plant may persist and flower a second summer, when it becomes yet more intricately branched.

The hair-clothing of this species is likewise variable, although the nature of the individual hairs seems uniform and characteristic, these being straight and spreading, more or less flattened, and hyaline or whitish in colour. Hairs are usually present on the surfaces and margins of the leaves of the basal rosette, and are often abundant there. Frequently they are equally numerous on the cauline leaves and the stems, but they always become more scattered on the peduncles. Some forms have the stem glabrate and its leaves only ciliate, or rarely both of these are entirely glabrous. The bracts of the umbels are nearly always pilose on the inner surface, but externally they may be pilose, ciliate, or glabrous.

At the time of flowering, minute whitish hairs, similar in character to those of the rest of the plant, may sometimes be seen on the angles of the calyx-tube or even over its entire surface, but they very rarely extend to the calyx-teeth. They appear to be readily deciduous, for I have seen no calyces in fruit that are not glabrous.

In British botany no endemic varieties of *Jasione montana* have been established, but plants similar to the large-headed form that I noticed near Ilfracombe have been referred to Koch's variety *major* by Beeby, E. S. Marshall, and others, and a dwarf prostrate form occurring on the sand-hills about Bournemouth has been identified by Townsend with var. *littoralis* Fries. In Macreight's *Manual of British Botany*, p. 146 (1837), a shore form from Portsmouth is named var. *maritima* DC.; and Mr. C. E. Salmon, at p. 321 of this Journal for 1917, has referred to the same variety a plant collected on the rocky coast of Holyhead. In the ninth edition of Babington's *Manual* (p. 272) Messrs. Groves also note the occurrence in Shetland of a dwarf form with large leaves and very large heads.

The number of varieties of *J. montana* distinguished by Continental authors is considerable. The earliest of these is var. *major* Mertens & Koch, Deutschl. Fl. ii. p. 147 (1826), the diagnosis of which runs: "Viele sehr ästige Stengel entspringen aus einer starken Wurzel und sind über 2′, folglich mehr als noch einmal so hoch als bei der gewöhnlichen Form; die Blüthenköpfe sind noch einmal so dick und die Hülle ist aus mehreren und stärker gezähnten Blättchen zusammengesetzt." No habitat is given, but in Koch's Synopsis Fl. Germ. p. 463 (1837) this is supplied—"In rupium fissuris montium porphyriorum ad fluvium Nahe Pilatinatus."

The variety *littoralis* Fries was established in Novitiæ Fl. Suecicæ, ed. 2, p. 269 (1828), with a description "Radix fusiformis, perennans videtur. Caules in densum cæspitem collecti, simplicissimi, prostrati, superne aphylli, adscendentes, digitales. Folia plana, glabra; caulina majora, sparsa, uninervia. Capitula duplo triplove minora, foliolis involucri ovatis obliquis obtusis integerrimis. Raro subhispida . . . In arenosis maritimis Sueciæ occidentalis. . ."

In 1828 this species was also dealt with by J. E. Duby in De Candolle's *Botanicon Gallicum*, ed. 2, i. p. 311, where three varieties are diagnosed, viz.:—

α. *lævis.* Caule ramosissimo erecto, foliis glabriusculis, calyce glabro.

β. *hirsuta.* Caule vix ramoso, hirsuto, foliis hirsutis, involucris acutis, calyce subglabro.

γ? *maritima.* Incano-pilosissima, caule prostrato subsimplice, foliis brevibus, involucri squamis exterioribus obtusis, calycibus hirsutis. In maritimis Galliæ occidentalis. An distincta species?

A second variety *maritima*, seemingly different from Duby's plant, appeared in 1836 in Brébisson's *Flore de la Normandie*, p. 179, and is described as "Tige basse, très velue ainsi que les feuilles, qui sont courtes; capitules larges. Roc de Granville." Of this variety Corbière (Fl. de la Normandie) remarks: "Plante basse (3–10 cm.), hérissée," and Lloyd (Fl. de l'ouest de la France) adds: "fleurs plus pâles" [than the type].

In De Candolle's *Prodromus*, vii. p. 415 (1839), the varieties of *Jasione montana* stand thus:—

β. *maritima* Duby. . . . .
γ. *littoralis* Fr. . . . .
δ. *stolonifera*. Radice stoloniferâ, stolonibus rosulatis, foliis ovatis pilosis marginatis integris, pedunculo elongato glabro nudo, bracteis ovatis crenatis pilosis. In Calabriâ.
ε. *major* Koch. . . . .
ξ. *prolifera* (Bell. Act. tur. v. p. 247). Capitulis proliferis.
η. *dentata*. Bracteis spinoso-dentatis acutis. In Olympo Bithino.

It will be noticed that Brébisson's plant is not distinguished in this list, while δ is a stoloniferous South Italian form, ξ a monstrosity, and η an Eastern plant. This last is probably identical with the Balkan *J. Heldreichii* Boiss.

Willkomm and Lange (Fl. Hispanica, ii. p. 280 (1870)) introduce two new varieties under *J. montana*, at the same time defining with some accuracy the specific type.

The first variety, β. *echinata*, already described as a species by Boissier, is a tall, erect, and usually very hirsute plant, with rather large flower-heads, frequently bluish-tinted bracts, and very long, rigid calyx-teeth. The second variety, *gracilis* Lange, *Pugillus*, p. 155 (1866), is a dwarf, slender but erect form, with very small heads, borne on long peduncles and enclosed in broad bracts.

The variety *maritima* Duby is transferred by Willkomm and Lange to the Pyrenean *J. humilis* Lois.

In Rouy's *Flore de France*, x. p. 91 (1908), the arrangement under *J. montana* is :—

β. *littoralis* Fr. . . . . (littoral de l'Océan et de la Méditerranée; Corse).
Subvar. *nana* (G. & G. pro var.). Plante trapue, à tiges de 2–10 cent., très hérissées, capitule gros.
γ. *Borœi* nob. Plante grêle, naine (2–6 cent.); capitules très petits; fleurs sessiles. (Creuse.)
δ. *Timbali* nob. (var. *gracilis* Icanb. & Timb. Llaurenti, p. 227, non Lange). Plante basse, diffuse, à tiges grêles; capitules très petits; involucre à fol. ovales-acuminées, entières; calice glabre; fleurs à pedicelles égalant les divisions du calice. (Pyrénées.)
ε. *major* Mert. & Koch. . . . (çà et là, vallées boissées et humides).

Race (maritime) *J. maritima* Duf. (pro spec.) ap. DC. Prod. vii. p. 415 (*J. montana* γ. *maritima* Duby, Bot. Gall. i. p. 311, non Bréb.; *J. humilis* γ. *maritima* Willk. Fl. Hisp. ii. p. 283). . . . . (Sables maritimes de l'Océan.)

Race (méditerranéenne) *J. mediterranea* Rouy. Se distingue du *J. maritima* . . . . par tiges glabres et longuement nues supérieurement . . . . ± longues (8–30 cent.); folioles de l'involucre épaisses, glabres, fortement dentées. (Corse.)

Still more recently a further variety, *sabularia*, has been described in Coutinho's *Flora de Portugal*, p. 603 (1913). This is characterized by an ascending habit, with many simple or slightly branched stems, and moderate-sized heads on relatively short peduncles. It is represented by one poor example in the National Herbarium.

Reverting to the British forms of *J. montana*, the variety *major* Mert. & Koch, to which our large-headed plant of the western coasts has been referred, may first be considered. Of this variety there is an undoubted specimen in Herb. Mus. Brit. from the Nahe Valley in the Palatinate (Wirtgen, Fl. Rhenan. Fasc. ix. 502), and similar examples there and in Herb. C. Bailey from Hagenau (Billot, No. 50, as *J. montana*) and the Harz District (Blankenburg) respectively. These plants agree with the description in being tall (5–6 dm.) and robust, with large flower-heads. They are sparingly hairy; with linear-oblong stem-leaves up to 30 mm. long and 4 mm. broad; and ovate-acuminate, toothed bracts, scarcely equalling the hemispheric heads of rather long-pedicelled flowers. They do not resemble the plant of our rocky coasts, which clearly differs by being of lower stature though equally robust, and in having broader, thicker, and more pilose foliage, and flatter heads of more shortly pedicelled flowers, subtended by much larger and broader bracts. But there is an inland specimen in Herb. Mus. Brit. (Woburn Sands, Beds. 1886. Hb. A. French) which seems inseparable from var. *major*, and another in Herb. C. Bailey (Sale, Cheshire, 1862). In Mr. Bailey's collection there is Hungarian material sent out by Richter as var. *major*, less robust and more pilose than Wirtgen's plant and approaching the specific type; and intermediate forms may probably be found in other districts. This variety is admitted by Rouy as a French plant of occasional occurrence.

The dwarf, prostrate, and sometimes densely tufted plant which grows on the sandy cliffs and dunes around Bournemouth seems to have been correctly identified with var. *littoralis* Fr., as generally understood. But there is this notable discrepancy. Fries describes the stems as "simplicissimi," which presumably means unbranched and would bring the plant towards var. *maritima* Duby. A fruiting specimen at Kew, however, received from Fries and labelled "Scan. Austr. Ystad. Leg. E. Fries," is much branched above, just like the specific type late in the season; and other Swedish and North German material in Herb. C. Bailey shows the same habit. Prof. Lindman suggests *in litt.* that Fries's original description was taken from a starved form at Ystad, and that subsequently, without amending his diagnosis, he included with it more normal plants of the Swedish shores, where *J. montana* apparently occurs in great variety, from dwarf prostrate forms, branched or unbranched, with small heads, to decumbent large-headed forms and erect plants inseparable from the typical species. Prof. Lindman thinks the only valid feature of var. *littoralis* is its prostrate habit, and does not regard it as a very good variety; and he further points out that its involucral bracts are not ovate and entire, as described by Fries.

The Bournemouth form, though much branched when well grown, seems to be more uniform than the Swedish shore-plant, and to agree more closely with Fries's original diagnosis and the exsiccata which he issued. It is therefore thought best to retain Fries's name, as is done by French authors for what appears to be a similar shore-form widely distributed in France.

With regard to Duby's variety *maritima*, I think that Willkomm and Lange, and later Rouy, were obviously right in separating it from *J. montana.* There is excellent material of this plant in Herb. C. Bailey from the Gironde district (Magnier, No. 2519, &c.), from which its features can be well seen. As stated by Duby and subsequent authors, it produces a number of long, prostrate stems from the rootstock, each terminating in a single flower-head and remaining permanently unbranched. Its stem-leaves are numerous. very small (5–8 mm. long), thick and recurved, and extend further towards the flower-head than in any form of *J. montana.* The umbels, which are quite small (10–15 mm. broad) and composed of shortly pedicelled flowers, are surrounded by very small, obtuse bracts, much shorter than the heads. The calyces are more or less pubescent, with broad and densely long-hirsute teeth, which impart a hairy aspect to the flower-heads ; and this condition persists in fruit. This plant seems to be of more than biennial duration.

I am not aware whether any Portsmouth specimen exists of the var. *maritima* mentioned by Macreight (*Manual*, l. c.), but his description, as far as it goes, embodies some of the salient features (including the hirsute calyx) of the var. *maritima* of Duby and De Candolle; and his plant might have been rightly named, albeit Townsend, in his *Flora of Hampshire*, refers it to var. *littoralis* Fr.

Touching the Holyhead plant identified with var. *maritima* Duby (Journ. Bot. p. 321 (1917)), Mr. Salmon has kindly sent me his original specimens for examination, and these prove identical with my Ilfracombe form. They are in the flowering stage, and show the calyx-tube thickly clothed with the characteristic minute hairs often seen in *J. montana.* In some cases a few of these minute hairs are scattered on the calyx-teeth, and it is no doubt owing to the presence of these hairs that this usually erect and large-headed plant was associated with Duby's prostrate sand-dune variety.

It now remains to determine our handsome coast form, which has been named var. *major*, var. *maritima*, and even var. *littoralis.* It has already been shown that it is distinct from var. *major* Mert. & Koch, and a similar tall habit, with narrow leaves, long-pedicelled flowers, and very long, bristle-like calyx teeth, serves to separate var. *echinata* Willk. & Lange from it. It differs essentially, not only from var. *maritima* Duby, but from var. *littoralis* Fr. and var. *sabularia* Cout., by its more erect habit, and its large leaves, bracts and flower-heads. Evidently it has no connection with the dwarf varieties *gracilis* Lange, *Boræi* Rouy, and *Timbali* Rouy. The remaining form with which it invites comparison is Brébisson's var. *maritima*, which seems identical with var. *nana* Gren. & Godr. This is said to be a low, hairy plant (3–10 cm.), with short leaves and large, pale heads, and is recorded from maritime rocks in Western Normandy. I have seen no authentic examples of this plant, which may possibly resemble the Ilfracombe form but for its dwarf growth; and unfortunately its description is very incomplete. But it is strange that Rouy should reduce it to a sub-variety *nana* of var. *littoralis* Fr., however dwarf its growth, if it is a form of our robust coast plant. There is no Continental material that matches our form in Herb. Mus. Brit., Herb. Kew or Herb. C. Bailey, while these herbaria possess numerous examples from the west coast of Great Britain, extending to Shetland, and from many Irish maritime or submaritime localities. It therefore seems reasonable to regard this plant as an endemic British form, and to place it under *J. montana* as a new variety, which it is proposed to name *latifolia* in allusion to its relatively large and broad foliage.

It will be noticed that while recent authors have maintained or raised the status of Duby's var. *maritima*, they have not adopted his varietal names *lævis* and *hirsuta*, which are also omitted from De Candolle's *Prodromus*. This is no doubt due to the difficulty, or rather impossibility, of dividing the species into two classes based on Duby's characters. Willkomm and Lange (*Fl. Hispanica*, l. c.) treat the specific type as a plant with stems and foliage more or less hispid, though less so than in var. *echinata*. Probably glabrate forms are rare or absent in Spain. In Britain, too, the hirsute form predominates, but clearly separable glabrate forms also occur, and it is perhaps permissible to take Willkomm and Lange's view of the type and to regard plants with glabrous or merely ciliate stem-leaves as a form *lævis*.

The dwarf varieties *gracilis*, *Boræi*, and *Timbali* are not known to occur in this country, but Brébisson's variety *maritima*, whether a dwarf ally of var. *latifolia* or a form of var. *littoralis*, may be looked for on our southern sea-cliffs. Forms of sheepsbit, not exceeding one inch in height, have been recorded for the Cornish coast.

Other less distinct forms also exist in Britain, such as the prostrate plant of the sand-dunes of Wallasey Island, which resembles some Swedish forms that have been named var. *littoralis* Fr. With our present knowledge, however, it seems desirable to leave it under the specific type and to restrict Fries's name to the more distinct Bournemouth form.

The British forms of *Jasione montana*, excluding var. *maritima* Duby, which does not seem conspecific and is of improbable occurrence here, may be distinguished thus:—

JASIONE MONTANA L. Sp. Pl. 928 (1753).

Stems usually numerous, suberect and 10–40 cm. high, or more or less decumbent, or rarely prostrate; cauline leaves linear-oblong or linear, 10–25 mm. long and 2–4 mm. broad, obtuse, more or less pilose. Involucral bracts ovate or rhomboidal, generally acute or acuminate, slightly toothed or entire, pilose throughout or externally glabrous, ciliate or not, rarely exceeding the flower-heads, which are 12–18 mm. broad (later axillary heads smaller). Flowering pedicels 1½–twice as long as the calyx-tube. Calyx-tube generally glabrous, but occasionally minutely pilose; teeth glabrous, setaceous, usually erect and rigid in fruit.

Widely distributed in Britain.

b. LÆVIS forma nova.

Exsicc. Trimen, Hounslow, 1866, in Hb. Mus. Brit., ut *J. montana*!

Caulis pars superior et folia caulina (infimis exceptis) glabra vel interdum folia ciliata. Involucri bracteæ externe glabræ.

Upper part of the stem and cauline leaves, except the lowest, glabrous, or the leaves ciliate. Involucral bracts externally glabrous.

Occurs in sandy districts of South-East England and probably elsewhere.

β. MAJOR Mert. & Koch, Deutschl. Fl. ii. 147 (1826).

Exsicc. Wirtgen, Fl. Rhenan. Fasc. ix. 502!

Stems suberect, robust, 30–60 cm. high. Cauline leaves linear-oblong, 25–30 mm. long and about 4 mm. broad, ciliate or sparingly pilose. Involucral bracts ovate, acuminate, somewhat dentate, usually glabrous externally, not exceeding the heads, which are 20–25 mm. broad. Flowering pedicels rather long, as in the type. Calyx as in the type.

Known in Britain from Beds (Woburn Sands, Hb. A. French in Hb. Mus. Brit.) and from Cheshire (Sale, in Hb. C. Bailey).

γ. LITTORALIS Fr. Novit. Fl. Suec., ed. 2, 269 (1828).

Exsicc. E. Fries, Ystad, Scan. Austr., in Hb. Kew! E. F. Linton, Parkstone, 1890, in Hb. Mus. Brit.!

Plant dwarf, with slender, nearly prostrate stems from the original rosette, becoming more or less branched above and sometimes finally forming a matted tuft. Cauline leaves small, oblong or linear-oblong, 5–10 mm. long and 1·5–2 mm. broad, glabrate or rarely pilose. Involucral bracts generally rhomboidal rather than ovate, acute or obtuse, subentire or with few teeth, usually glabrous externally, and not exceeding the heads, which are 6–12 mm. broad. Pedicels relatively shorter than in the type. Calyx of the type, but with shorter and less rigid teeth.

Occurs in Britain on the cliffs and sand-hills around Bournemouth.

δ. LATIFOLIA var nov.

Exsicc. E. S. Marshall, Hurlstone Pt., W. Somerset, 1907, in Hb. Mus. Brit., ut *J. montana* var. *major*! H. H. Johnston, Eday, Orkney, 1883, in Hb. Kew, ut *J. montana*! Britten & Nicholson, Bray Head, Wicklow, 1881, in Hb. Mus. Brit., ut *Jasione* ——!

Robusta, parce ramosa, caule primario quam in aliis formis magis distincto, suberecta vel caulibus secundariis decumbentibus, 10–30 cm. alta. Pedunculi ut caules interdum pilosi. Folia caulina oblonga vel obovato-oblonga, 10–25 mm. longa et 4–9 mm. lata, obtusissima, pilosa, marginibus incrassatis nonnunquam undulato-crenata. Bracteæ magnæ, late ovatæ (in formis montanis hibernicis angustiores), acutæ vel obtusæ, marginibus incrassatis obscure dentatæ, sæpissime externe pilosæ, calathia quæ 20–30 mm. lata quam in aliis formis planiora sunt æquantes vel etiam superantes. Pedicelli sub anthesin quam in typo breviores. Calycis tubus glaber vel minute pilosus; dentes glabri vel rarissime pilis sparsis brevibus præditi, subulati, plane uninervii, quam in typo latiores brevioresque. Corolla quam formarum aliarum nonnunquam pallidior.

Plant robust, more sparingly branched and with a more distinct central stem than in other forms, suberect or with decumbent branches, 10–30 cm. high. Peduncles sometimes pilose like the stem. Cauline leaves oblong or obovate-oblong, 10–25 mm. long and 4–9 mm. broad, very obtuse, pilose, with thickened margins, sometimes undulate-crenate. Involucral bracts large, broadly ovate (narrower in Irish mountain form), acute or obtuse, obscurely toothed with thickened margins, usually pilose externally, equally or exceeding the heads, which are 20–30 mm. broad and flatter than in other forms. Flowering pedicels shorter than in the type. Calyx-tube glabrous or minutely pilose as in some other forms of the species; teeth glabrous or very rarely with a few short, pilose hairs, subulate, distinctly one-nerved, broader and shorter than in the type. Corolla sometimes paler in colour than in other forms.

This apparently endemic variety is found on rocky coasts of the western side of Great Britain from Cornwall to Shetland, and is widely distributed in Ireland.

I have seen specimens from Cornwall (St. Ives! Newquay, Hb. Mus. Brit., as var. *littoralis*), North Devon (Ilfracombe! Lundy Isd., Hb. Mus. Manchester), W. Somerset (Hurlstone Pt., E. S. Marshall, as var. *major*), Anglesea (Holyhead, C. E. Salmon, as var. *maritima*), Orkney (Eday, Johnston) and Shetland (Unst, Beeby, as var. *major*); and in Ireland from Dublin (Howth, Blackwood, as var. *major*), Wicklow (Bray Head, Britten & Nicholson), Kerry (Brandon Mt., E. S. Marshall, No. 3661, as var. *major*), Clare (Kilkee, Hb. E. F. Linton, as var. ——), Galway (Clonbar, E. S. Marshall, as var. *major*; Renoyle, Miss Blake, as var. *maritima*), and Mayo (Killary Bay).

THE LICHEN LIFE-CYCLE.

By A. H. Church.

(Concluded from p. 202.)

VI. Concluding Remarks.

In thus considering the bearings of these associated groups of Laboulbeniaceæ and Florideæ, one is inevitably drawn to the conclusion that the Lichen Fungi represent a distinct horizon of vegetation, quite apart from their secondary connection with intrusive algæ; though the delimitation of the group from cases of comparable parasitic attack by other fungus-races on algal forms may still remain very vague. The fiction of the 'Consortium' leads nowhere; the real story is much more marvellous than any lichenologist has so far outlined. The striking individuality of the race is vindicated far beyond the dreams of an older school (Crombie) who were grieved at the indignity suggested by the symbiotic theory of Schwendener[1]. There can be no doubt that in their varied types of soma Lichens retain the form-factors of marine algæ, to the extent that they still present, in many cases very accurately, the appearance of bilateral dichotomizing frond-systems, and the fruticose and encrusting vegetation of modern tide-pools (*Chondrus*, *Gigartina*, *Melobesia*, *Ralfsia*). In their asexual sporangial phase they suggest the retention of a type of unilocular sporangium behind the state of existing *Dictyota*, or the horizon of the Florideæ. On the other hand, in their sexual reproduction they retain vestigia of a secondary mechanism of the marine process of fertilization, in terms of the attachment of 'spermatia' of sorts to a 'trichogyne' of sorts, in many respects following the lines of the Laboulbeniaceæ; and, though in details as widely divergent from the analogous process[1] obtaining in the Florideæ on the one hand, as from that of the Laboulbeniaceæ on the other, their method may be the one lying behind the more vestigial relics traced in modern saprophytic Ascomycetes.

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[1] De Bary (Eng. Trans., 1887) p. 418.

Putting these results together, one has ample reason for regarding lichens as representing the relics of a distinct race, directly transmigrant from the sea, but presenting while still in the sea a somatic organisation of high grade, fully complementary to the advanced conditions of their reproductive mechanism and life-cycle; and it is, in turn, possible to outline the stages of their progression to subaerial conditions. The same biological factors of reef-pool formation which produced the Florideæ, also lie behind the whole series of Ascomycetes in the wider sense of ascus-bearing plants, however polyphyletic in this respect. In pool-formations of standing water these heterotrophic survivors have picked up intrusive algæ, to recover vicariously photosynthetic relations with the free atmosphere. In the same stagnant pools other types of the Laboulbeniaceæ, originally saprophytic on abundant decaying animal forms, have passed on to obligate parasitism on races of transmigrant arthropods, to follow the insect-progression, and by the aid of the locomotor mechanism of such organism to attain the more aerated levels, and ultimately to be exposed on short-lived flies to the chances of free and dry air. Similarly the Lichen-series, left exposed in the long run by the periodic or permanent drying up of such ponds, indefinitely progressive and regressive, becomes ultimately xerophytic in growth-form, and capable of enduring the most extreme desiccation, to recover again in casual supplies of atmospheric precipitations,—thus enduring conditions under which no higher transmigrant life has been able to exist permanently, and finding abundant stations on exposed bare rock beyond much chance of competition, to remain to the present time practically at a standstill. Fertilization, if effected at all, is dependent on casual rain-water, as the xerophytic Laboulbenias can be only fertilized in chance moisture on the insect, or in the case of the return of the latter to the water, either living or dead,—with again the chances of all possible phases of sexual deterioration in cytology[2].

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[1] The term 'spermatium' was originally applied to Lichens, and was transferred to Florideæ (replacing 'antherozoid') more particulary after Stahl (1877) had shown their presumed function in attachment to the 'trichogyne' of *Collema*. The Floridean 'spermatia' of Kuetzing (1843) were carpospores. On the other hand the word 'trichogyne' was definitely applied first to Florideæ by Bornet and Thuret (1867, Ann. Sci. Nat., p. 141), and was similarly transferred to structures biologically vaguely comparable, though clearly of no morphological identity, as in the cases of *Coleochæte*, *Pyronema*, *Collema* (*cf.* Sachs, 1874, Eng. Trans., 1882, p. 284), and hence to Laboulbeniaceæ (De Bary, 1884; Thaxter, 1896).

[2] Faull. Ann. Bot. xxvi. p. 350 (1912) for apogamy, pseudogamy and phenomena of conjugate nuclei.

In all cases the full type of sexual mechanism alone demands special consideration, as representing theoretical conceptions of syngamy, and hence the primitive aspect of the life-cycle. Drawings of the early stages of the formation of ascogenous hyphæ (Baur, Nienburg), as available, are not readily distinguishable from figures of the phenomena seen in the development of the carposporophytes of the more generalized Florideæ (*Chondrus*, *Gigartina*). The mechanism remains distinctly algal, aquatic, and essentially marine in inception. That every condition and possibility of deterioration in the original cytological mechanism should obtain, or even be general, goes without saying, as the chances of maintaining aquatic (plankton) gamete-fusions become the more difficult or hopeless under subaerial conditions. Again, this follows as a matter of course, immediately it is recognised that these plants are, at best, only the most depauperated and residual of algal types, and by no means up-grade products of syntheses, in which sexual mechanisms are being constituted *de novo* to suit the conditions of the land. Hence examples, however abundant, of apogamy, parthenogamy, or in the limit, pseudogamy, though complicating the story of individual genera, acquire very subsidiary importance[1]; as again does the general elaboration of communal sporophytes, where the developing asexual ramuli of adjacent sexual carpogonia become interwoven to a confluent hymenium, or the zygote itself is communal and cœnocytic. None of these phenomena would excite much surprise in the case of modern Florideæ of the sea, any more than does the complete loss of sexual mechanism in certain forms (*Rhodochorton* and many Chantransias), or the suppression of the tetrasporangial stage in others (*Nemalion*, *Scinaia*)[2]. The same applies to the Laboulbeniaceæ, and a neat example is given by Faull, in which pseudogamy follows by the utilization of a migrant daughter nucleus of the trichophoric cell[3]. Similarly after demonstration of the remarkable phenomena of the possibilities of nuclear migration in the post-sexual phases of 'auxiliary cell' mechanism, similar nuclear migration in Lichen-carpogonia, not only become inherently probable, but the case of presexual nuclear translation, rendered possible by the retention of 'primary pits,' in achieving the act of syngamy (undoubtedly effective at some time in the case of the Laboulbeniaceæ[4], even if not directly observed in living forms) may be accepted as equally probable in the filamentous carpogonial ramuli of Lichens; again with equally a very secondary application to the original theme. In absence of a more definite key to the origin of these groups, the expression of reproductive abnormalities has attained undue prominence; their only interest lies in the determination of the lines of progressive failure in older established mechanism once initiated in the sea[1].

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[1] However exciting to the cytologist; *i. e.* nuclear phenomena as inherited from the cell-soma of the plankton-phase, require to be wholly dissociated from the structural morphology, in terms of larger aggregates in tissues and members of the benthic phase.

[2] Cleland (1919) Ann. Bot. xxxiii. p. 343 (1919).

[3] Faull (1911) p. 652, suggestive of the mechanism of initiating phenomena of pseudogamy.

[4] That no true sexual fusions have been so far observed is phyletically immaterial.

The general aspect of the life-cycles of all these series is sufficiently clear. *No plant-phylum has made good in subaerial environment, unless it had previously, in the sea, attained to a two-phase life-cycle*, in which the asexual spores, no longer water-demanding, might be utilized as perennating, more or less air-dried, and protected dispersal units. But in the rigour of the new conditions of desiccation, and possible failure of nutritive metabolism over long periods, every phase of somatic and reproductive deterioration becomes possible. With the ultimate failure of the original aquatic mechanism of cross-fertilization, conditions of autogamy may still be successful in lesser degree; as the latter in turn may be abbreviated by pseudogamy, affording a last possibility in retaining a certain amount of meiotic benefit of the subsequent spore-stage. If this cannot be done, the asexual generation may continue as a deteriorated haploid expression, or else it is obliterated. With it goes the initial possibility of free dispersal by airborne-spores, and the further progression of the organism as a 'higher' land-plant is closed for ever.

The gametophyte generation alone can only endure as a land-plant by vegetative methods of propagation; and that such may be possible to a practically indefinite extent is shown by the preponderance of adaptive 'conidial' stages in many saprophytic Fungi (*Penicillium*, *Eurotium*), as also by the full multiplication of many Lichens by soredia,—a lucky solution of the problem which probably just saves many races; though, as in the case of the conidium-producing fungus, leaving the type in a wholly elementary phase of reproductive progression, without the benefit of sexual fusion and its meiotic consequences. As the gametophyte by itself is thus useless for further upward progression in competition with better equipped races, so the sporophyte of such fungus-series fails to make any further advance when left alone (*Exoascus*); in that it had already lost in the sea (under conditions parallel with the case of the Florideæ) the somatic organization of this decadent and parasitic phase following fertilization *in situ*[2]. It remains interesting to note that the more successful dominion of the land has been attained by algal forms of more mediocre attainment, so far as extreme reproductive specialization is concerned; *i. e.*, they must have retained a sporophyte of distinctly homologous (homothallic) construction, capable of still holding its own as a free autotrophic individual (Pteridophyta), with photosynthetic ramuli of freely dichotomizing systems of ramification (Filicineæ); as, on the other hand, the gametophytes retained the original method of zoïdogamy by a flagellated antherozoid. The Lichen Fungi, with associated spermatogamic phyla of Florideæ, Ascomycetous fungi, and Laboulbeniaceæ, are thus left as *Landmarks of Limitation*, as expressing the ultimate possibilities of reproductive progression in the sea. Of all the heterotrophic survivors of the land the Lichens, again, present in their indefinitely organized carpogonial ramuli suggestions of a phase possibly as much beyond that of the very precise type of the Laboulbeniaceæ, as it may be behind that of more siphonogamic saprophytic Ascomycetes, as the least changed of all these minor marine transmigrants. A common scheme of subaerial progression from a wasting sea-front affords the best clue to all such secondary and extreme plant-adaptations; the different races succeeding in proportion to their original equipment and the satisfactory solution of their wastage problems. Beyond the elaboration of perennating spore-origins they show little that is structurally new; and, in virtue of an improved method of food-supply, the whole of the older mechanism of nutrition becomes more or less vestigial; though least so in the Lichens with their early exploitation of algal hosts with comparable metabolism. The more novel the secondary sources of food-supply, the wider the races diverge in general appearance; but the constitution of the life-cycle remains unaffected, except in extreme phases of decadence. The isolation of these divergent groups is thus the expression of the *possible modes of heterotrophic existence, rather than any indication of range of 'affinity.'* The business of the lichenologist is to determine the method of progression within the lichen-series, bearing in mind the algal equipment of the sea and the capacities of the primal transmigrants; as the algologist has to explain the conditions under which the initial types of algal soma, with their potentialities and limitations, came to be evolved[1].

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[1] For a good account of the substitution of vegetative growths and fusions for the original sexual organs, cf. *Polystigma rubrum* (Blackman and Welsford, Ann. of Bot. 1912, p. 765), which probably gives the key to a wide range of phenomena of pseudogamic deterioration.

For interesting example of a mechanism for secondary autogamy in *Collema pulposum*, cf. Bachmann, Ann. of Bot. 1912, p. 753.

[2] Thus *Exoascus* has admittedly lost its sexual phase and appears now as a mere normal hymenium of asci. The spores readily germinate in sprouting form, the sprouts being readily-detached conidial-ramuli of algal mechanism. Yeast-fungi (Saccharomycetes) apparently represent a retention of this last stage of vestigial somatic organization, and are by no means 'elementary' organisms. It is certainly a far cry from a complex autotrophic marine alga to a vestigial heterotrophic sprouting fungus, living most precariously for a short time in the year on the surface of fruits of higher land-flora; but it may be also pointed out that the fusions of 'conjugating' Yeasts, often described as 'hologamic' (*cf.* Guilliermond (1913), *Rei Progressus*, p. 434) are preferably to be regarded as indicating the fusions of ramuli, which come directly into line with the generally accepted phenomena of *pseudogamy*.

Such generalizations undoubtedly tend to promote a wider outlook on these little known and often despised plants, and the details which often appear merely tedious in the great wealth of genera and species. As plant-monographers cease to be plant-biographers, the different series tend to be relegated to the domain of specialists, and excite no general interest. The present suggestions obviously touch but the merest fringe of the story, but they may help to introduce the subject in a new guise to many who have so far never stopped to think of the meaning which may lie behind the accumulation of obscure facts. The fiction of the consortium dies hard among modern lichenologists, as the dual nature took long to be generally accepted. But in the story of the subaerial transmigration a unifying system of biological correlations may be outlined, expressing the varied fortunes of many algal races of the sea in the intensified struggle for existence during the vicissitudes of such a change of phase. There is little question of tracing fanciful lines of phyletic descent,[1] but it should be possible to reconstruct the biology of the phases of the progression in the response of divergent organism of similar horizons to the changing conditions of their environment. In recasting the history of such ancient epochs, no point or detail is too small to be without some bearing on the case; even the works of previous writers may be re-examined for more vivid interpretations, and one begins to take a renewed interest even in the commonest types when they are viewed from a new angle. There can be no doubt that in the organization of these curious survivals there may be traced the history of many lost races, which may afford confirmatory evidence of the determining factors of plant-progression, its aims and ultimate significance in the world-scheme.

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[1] Bot. Mem., 10 (1920). 'Somatic Organization of the Phæophyceæ.'

JAMES YATES'S DRAWINGS OF CYCADS.

By James Britten, F.L.S.

It is somewhat remarkable that in the account of James Yates (1789–1871) in the *Dictionary of National Biography* (lxiii. 297), which deals at length with him as "unitarian and antiquary," no reference is made to his botanical work in connection with the *Cycadaceæ*. Both his collection of these at Lauderdale House, Highgate (now included in Waterlow Park), to which he retired in 1848 and where the rest of his life was spent, is described by Seemann (Bot. Herald, 201) as "the most extensive ever brought together in any garden, public or private"; his specimens and drawings—the former described in the Report for 1866 as "a large and highly interesting collection of specimens, consisting of sections of stems, fronds, male and female cones in various stages of growth, separate parts of fructification, etc."—are in the National Herbarium. The specimens were presented by him in the year mentioned: the drawings were at his death given by his widow to the Linnean Society (of which Yates became a Fellow in 1822), by which body they were transferred to the Department of Botany in 1914. It is of these latter that I propose to give some account.

1. *Cycas circinalis.* "Male cone of a *Cycas* (perhaps *sphærica*) produced in the Bot. Garden, Copenhagen, and sent A.D. 1849 to the Horticultural Society, London." "P. Iustyne delt.," 1849, elephant folio.

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[1] Academic schemes of phyletic progression from incipient squamulæ to crustaceous and foliaceous forms, postulating stray mycelium of unknown origin, are more reminiscent of the vague ideas of spores scattered on the primal naked surface of the earth, apparently as special creations (Lauder Lindsay, British Lichens, 1856, p. 80), than of modern scientific demands for some reason for such happenings, and some deeper conception of origins. The point still remains to account for the Alga and the Fungus being there, and the mechanism of their antecedent evolution (*cf.* A. Lorrain Smith, Lichens, 1921).

2. "Venation of *Cycas circinalis* in a leaf cut Dec. 7th, 1847, from a plant at Chatsworth."

3. "*Cycas revoluta*, female, Chatsworth, 1846. N.B. The leaves ill drawn. Scales immature." Unsigned, see 10.

4. "*Cycas revoluta*, male; Lauderdale House, July, 1866." P. Justyne, not signed.

5. "Two scales with fruit from the female *Cycas revoluta* which flowered at Chatsworth, 1846. Richard Smith del.

6. "*Cycas revoluta*, Lauderdale House, July, 1853: half the natural dimensions." Signed "G. Scharf del," elephant folio. From the plant described by Yates in Proc. Linn. Soc. ii. 253.

7. "*Stangeria paradoxa*, Lauderdale House, 1854: male plant, with two cones, Royal Botanic Garden, Kew, 1853: nut and seedling, Kew, 1854." Signed "C. C. Sowerby," elephant folio. The artist was doubtless a daughter of James Sowerby (1757–1822), the well-known botanical artist; the plates in Henderson's *Illustrated Bouquet* (1857–64) are mostly by her, and are lettered "Miss Sowerby del.": her name however appears as "C. C. Sowerby" on plate 10, the first executed by her.

8. "Cones of *Dionedule*, Lauderdale House, 1850." Signed "P. W. Justyne, 1850."

9. "*Zamia caffra*, Nov. 1847, Chatsworth Conservatory." Pencil drawing of whole plant: inscription probably by artist.

10. "*Encephalartus caffer*, Chatsworth, 1847. N.B. The leaves ill drawn: cone still immature." Unsigned: by the draughtsman of 3.

10 *a*. "Leaf of *Encephalartus caffer*, half the natural size, from a plant at Chatsworth, Decr. 1847."

11. "Scales with fruit of the *Encephalartus caffer* which flowered at Chatsworth A.D. 1848, drawn by R^{d}. Smith." £2 2*s*. is noted as the price.

12. "Leaflets of *Encephalartus caffer*: drawn by Sophia Yates, Norton Hall, Derbyshire, September, 1847."

13 (1). "*Zamia pungens*, Kew Gardens, 1839. Reduced to one 6th & pits natural size." Atlas folio.

(2). "Cone of the *Zamia pungens*, its natural size, Kew Gardens, 1839." Atlas folio.

Both inscribed "Mrs. Withers del^{t}., Flower Painter in Ord^{y} to Queen Adelaide." Drawings identical with these are also in the Department. The former is referred to by Mr. J. Hooker in Bot. Mag. t. 4903 (1856), but not named: he refers to "a fine old Encephalartus introduced by Masson . . . . of which an atlas-folio figure was engraved from the pencil of Mrs. Withers, and published under the name of *E. pungens*." Sir David Prain kindly informs me that nothing has been found at Kew to show that a drawing of the plant by Mrs. Withers was ever engraved, but a letter from Yates to Hooker refers to a drawing of the Kew specimen made in 1839 which was sent to Hooker and returned by him, and this is doubtless the figure mentioned above. Mrs. Withers's drawings were exhibited at the Linnean Society on Jan. 21, 1840 (see Proc. Linn. Soc. i. 52).

13 *a*. "Axis of a cone of *Encephalartus pungens*. Oct. 27th, 1849. Chatsworth Conservatory" (pencil drawing).

14. "Male cone of *Encephalartus horridus* produced at Chatsworth 1850. Sophia Yates del."

15. "*Encephalartus horridus* female, Lauderdale House, about 1855." P. W. Justyne (not signed), elephant folio.

16. "*Encephalartus horridus* female, Lauderdale House." J. De C. Sowerby (unfinished) with fragment of letter ". . . . unfinished Drawing but must beg you to keep it. The infirmity of age prevents my finishing it so pray retain it as my last attempt."

17. *Zamia Chigua* Seemann. Plate xliii from "Botany of the 'Herald.'"

18. "*Zamia Fischeri*. Lauderdale House, 1851. Eliza Bostock."

19. "*Zamia integrifolia*. Male. Lauderdale House, 1850." P. W. Justyne (not signed).

20. "Reduced drawing of *Zamia muricata* Botanic Garden, Liverpool, Jan. 1848. Eliza Bostock."

21. Same, natural size (same place and artist).

22 & 23. *Zamia Skinneri* Warszew. and *Z. Lindleyi* Warszew. The drawings of these, by Warszewicz, were sent by him to Yates, who himself presented them to the Department of Botany: they thus formed no part of the collection received from the Linnean Society. The drawings are reproduced in Otto and Dietrich's *Allegemeine Gartenzeitung* for 1851 in connection with a paper (p. 145) by Dietrich in which Warczewicz's name is attached to the diagnoses. The latter is doubtfully identified by Seemann (Bot. Herald, 201) with the plant there described by him as *Z. Chigua*; should the two prove identical, Warszewicz's name (1851) will take precedence of Seemann's (1854). Yates sent Seemann—who incidentally pays a high tribute to the supreme knowledge of the order which he shares with Brongniart, Miquel, and Lehmann—full descriptions (*op. cit.* pp. 202, 253) of the two species, which Warszewicz procured for him; *Z. Skinneri* Yates grew at Highgate, but *Z. Lindleyi* arrived as "a mere squash" and nothing could be done with it. We have in the Herbarium a sketch by Yates and specimens of a young plant grown by him at Highgate, with others sent to him by Warczewicz: a note by Mr. Carruthers indicates that he considered Seemann's *Skinneri* differed specifically from that of Warszewicz.

24. "Male cone of *Ceratozamia mexicana* produced in Mr. James Yates's palm-house, Lauderdale House, Highgate, cut February 25th. 1859. Length 38 centimetres, circumference at the thickest part 25 centimetres, the scales in a single column from the top of the cone to the bottom about 44 in number, the number of columns about 22, making the number of scales altogether more than 900." "P. W. Justyne del. £2." Atlas folio [description in Justyne's hand ?].

25. "Leaf of *Ceratozamia mexicana*, half the natural size; from the plant which flowered at Chatsworth, 1848 (begun by Eliza Bostock, finished by J. A. Bostock and Sophia Yates)."

With the collection were two drawings:

"Group of Groogro Palms, Grenada: P. W. Justyne" [*Syagrus amara* Mast.].

[*Telopea speciosissima* Br.] "To the President of the Linnean Society of London, this drawing of a Blue Mountain Waratáh is most respectfully presented by their humble servant Geo. Sutter, F.L.S. Parramatta 20th of Novr. 1857." Signed "W. Griffith, 1857."

As supplementing the D. N. B. account, it may be noted that fossil as well as recent Cycads shared Yates's attention; it was in connection with his work on the former that Mr. Carruthers dedicated to him the fossil genus *Yatesia*. A paper by Yates on *Zamia gigas* and other fossil species is published in the *Proceedings of the Yorkshire Philosophical Society* for 1849: others of similar character are enumerated in R. G. C. vi. 465. At the Linnean Society in 1849, and again in 1853, Yates exhibited specimens and made communications of some length to the Linnean Society (see Proc. Linn. Soc. ii. 15–22, 253–255); and he contributed a large collection of living plants to the International Horticultural Exhibition held in London in 1866.

A letter to Seemann on the explosion of a cone of *Encephalartos horridus* was published in this Journal for 1863 (p. 73).

NOTES ON JAMAICA PLANTS.

By William Fawcett, B.Sc., and A. B. Rendle, F.R.S.

(Continued from p. 19.)

Triumfetta.

Linnæus adopted Plumier's genus *Triumfetta* (Gen. Pl. 344; 1737), and described both calyx and corolla apparently from Plumier's rough drawing (Nov. Pl. Amer. Gen. t. 8). Later in the same year he described at length (Hort. Cliff. 210), under the same generic name, a plant growing in Clifford's garden, which led him to alter his description (Gen. Pl. ed. 2, 243, 1742) and state that the perianth was single—not with both calyx and corolla. The description in Hort. Cliff. was cited in *Species Plantarum* (444, 1753) for the single species there named, *Triumfetta Lappula*.

In *Flora Zeylanica* (77, 1748) Linnæus had already founded a genus *Bartramia* on a plant in Hermann's herbarium (now in Herb. Mus. Brit.) with both calyx and corolla, and on an earlier page of the *Species Plantarum* (389) he gave the plant the specific name *B. indica*. Six years later (Syst. ed. 10, 1044) Linnæus included *Bartramia* in *Triumfetta* and altered the trivial, naming the species *T. Bartramia*. The earliest trivial is therefore *indica*; but as Lamarck subsequently described (Encyc. iii. 420, 1789) a *Triumfetta indica*, the identity of which is doubtful, we have adopted the Linnean name *T. Bartramia*. De Candolle (Prodr. i. 508) remarks "*T. Bartramia* (Linn. sp. 638) indeterminata manet, cum synonyma omnia ad diversas species pertineant," and adopts Jacquin's name *T. rhomboidea* (Enum. 22; 1760). Later botanists followed De Candolle, although there is no difficulty in ascertaining exactly what Linnæus's species is, namely the plant in Hermann's herbarium.

The synonymy cited by Linnæus depends on figures in Plukenet and Petiver, the determination of which is doubtful, and in any case does not affect the species name.

As regards the synonyms cited under the other Linnean species, *T. Lappula*, one, Plukenet's *Lappula Bermudensis* &c. is represented by a specimen in his herbarium in Herb. Sloane, which was determined by Hemsley (Bot. 'Challenger' Exp.: Bermuda) as *T. Lappula*. But the fruit—glabrous, 3-celled, with hispidulous spinules—is not that of *T. Lappula* but of *T. semitriloba*. The other specimens that we have seen from Bermuda collected by Lane, Moseley, and others, are also referable to *T. semitriloba*, and so far we have no evidence of *T. Lappula* occurring in Bermuda.

The other synonym is *Agrimonia lappacea* &c. of Sloane. A specimen in Sloane's herbarium, iv. 31, shows this to be a species hitherto undescribed (*T. Sloanei* nob.). It has recently been collected again by Ridley.

Triumfetta Sloanei, sp. nov. Suffrutex. *Folia* ovata aut rhomboidea ad lanceolata, sæpe subtrilobata, basi obtusa ad acuta, e basi 3–5-nervia, margine subregulariter dentata, supra pilis minutis stellatis obsita, subtus stellato-tomentosa mollia, 3–7 cm. l. *Stipulæ* filiformes, basi breviter lanceolatæ, hispidæ. *Sepala* linearia, apice subincurvata sed non cucullata, breviter apiculata, extus puberula, 5–7·5 mm. l., ·8–1·2 mm. lat. *Petala* oblanceolata, 4·5–6 mm. l., 1·3 mm. lat. sub apice. *Stamina* circ. 15; gonophorum atque discus adsunt; *carpella* duo. *Fructus* tomentosa, 2-locularis, 3–3·5 mm. in diam.; glochidia hispida, 2 mm. l.—Agrimonia lappacea &c. *Sloane Cat.* 92 and *Hist.* i. 211.

Hab. In fl. Jan.; St. Jago de la Vega, *Sloane* Herb. iv. 31! Constant Spring, *Ridley*! Herb. Mus. Brit. & Herb. Kew.

Near *T. Bartramia* L. and *T. excisa* Urb. (Symb. Ant. v. 413, 1908), but differs from the former in the sepals and fruit, and from the latter in the form of the leaves, those of *T. excisa* being described as "ambitu reniformibus basi excisis." Also near *T. hispida* A. Rich., which, however, has a 3-celled hispid fruit.

CORCHORUS.

CORCHORUS ÆSTUANS L. Linnæus diagnosed this species first in *Systema* ed. 10, 1079 (1759) from Patrick Browne's specimen supplemented by his drawing and description (Hist. Jam. 232. t. 25, f. 1); the specimen (without fruit) is in Herb. Linn., named *C. æstuans* in Linnæus's hand. The capsule is described by Browne as "oblong, prismatic, obtusely 3-cornered, 3-celled, corners 2-furrowed and verrucose." The drawing of the capsule shows it terminated with three bifid horns. Linnæus in the second edition of *Species Plantarum* (746) quotes Plukenet's diagnosis and drawing (Phyt. t. 127, f. 3) as a synonym, but the plant here represented is obviously *C. olitorius* L., as is confirmed by specimens in Plukenet's herbarium (Herb. Sloane, xcv. 28; xcix. 37); Jacquin (Hort. Vindob. i. 37, t. 85) pointed out that Plukenet's figure does not represent *C. æstuans*.

Lamarck (Encyc. ii. 104) describes *C. æstuans* from a cultivated plant; the figure (Illustr. t. 478) of the capsule is taken from

Gaertner, Fruct. i. t. 64. He then (*loc. cit.*) describes a specimen from India as a new species, *C. acutangulus*, stating that it is very distinct from *C. æstuans* in the form of its capsules, which are described as prismatic, with five sharp angles, of which two project more than the other three, with three bifid points at the summit. He quotes, as synonymous, Plukenet, t. 44, f. 1, of which there are specimens in Herb. Plukenet, undoubtedly *C. æstuans*; and we find nothing in Lamarck's description to distinguish *C. acutangulus* from *C. æstuans*.

De Candolle, however (Prodr. i. 504, 505), accepts both names, *C. æstuans* and *C. acutangulus*, but includes the former in a section of the genus in which the capsule is without horns at the apex, while *C. acutangulus* is put in a section in which the capsule has diverging horns.

Later botanists were apparently misled by De Candolle's arrangement, and the species became known as *C. acutangulus* Lam., as there was no known plant that corresponded with De Candolle's *C. æstuans*.

Macfadyen (Jam. i. 107) retains *C. æstuans*, quoting De Candolle's diagnosis, but did not know the plant as described; he redescribes the true *C. æstuans* under a new name, *C. campestris*.

Grisebach enumerates *C. æstuans* L. (under which he quotes *C. campestris* Macf.) and *C. acutangulus* Lam.; but did not see any specimens from the West Indies which he could assign to either species.

To sum up, we have no hesitation in treating *C. acutangulus* Lam. as a synonym of *C. æstuans* L., and therefore adopt the earlier name, *C. æstuans* L.

ALABASTRA DIVERSA.—Part XXXIV *.

By Spencer Le M. Moore, B.Sc., F.L.S.

1. Plantæ Rogersianæ.—VI.

(Continued from Journ. Bot. 1920, 80.)

In this part is presented another instalment of Archdeacon Rogers's plants. One of Thorncroft's from Barberton, communicated by the Archdeacon, is also included.

Geraniaceæ.

Pelargonium (§ *Myrrhidium*) **Rogersii**, sp. nov. Planta sesquispithamea, *caule* ascendente subtereti lignoso ad nodos aliquantulum tumido sparsim ramoso uti rami subtiliter pubescente; *foliis* parvis oppositis brevipetiolatis ambitu ovatis pinnatifidis segmentis paucis obovatis lobatis vel lobulatis (foliorum superiorum maxime imminutorum linearibus integrisque vel fere integris) arcte appresse scaberulis haud carnosis; *stipulis* late ovatis acutis tarde dehiscenti-

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* Types in the National Herbarium except *Schizoglossum Thieleri*, returned to Archdeacon Rogers, a small scrap and a drawing being alone retained.

bus puberulis; *floribus* mediocribus sessilibus ad apicem pedunculi puberuli folia longe excedentis binis (nonnunquam solitariis); *sepalis* lanceolatis vel lanceolato-linearibus acutis illis 3- his 1-nervibus nervis dorso prominentibus omnibus dorso scabridis; *petalis* 4 spathulatis obtusissimis posticis quam reliqui longioribus latioribusque; *staminibus* fertilibus 5; *ovario* scabriusculo.

Cape, French Hoek, 17519.

Folia inferiora usque 1·5–2 cm. long., sicca circa 1 cm. humectata 1·5 cm. lat.; superiora ± 5 mm. long.; illorum lobi summum 7 × 7 mm., sæpissime vero minores; petioli ± 5 mm. long., foll. summorum modo 1–1·5 mm., omnes subtiliter pubescentes. Stipulæ laxæ, brunneæ, 2–4 mm. long. Pedunculi plus minus patentes, 2·5–3 cm. long. Bracteæ stipulis similes, circa 3 mm. long. Calcar circa 4 mm. long. Sepala 7–8 mm. long. Petala alba, roseo-lineata, postica 12 mm., reliqua 10 mm. long. Antheræ 1·5 mm., ovarium 5 mm., stylus 3 mm. long.

The affinity would seem to be with *P. myrrhifolium* Ait. Of the flowers opened none was seen with more than 4 anthers, though the long filaments were always 5.

ANACARDIACEÆ.

Rhus tumulicola, sp. nov. Planta *ramulis* sat validis lenticelliferis glabrescentibus novellis piloso-pubescentibus; *foliis* petiolatis trifoliolatis (petiolis foliolis lateralibus subæquilongis supra complanatis leviterque excavatis vix alatis) piloso-puberulis cito glabrescentibus foliolis sessilibus obovatis vel obovato-oblongis obtusissimis apice mucronatis basi cuneatis margine integris raro undulato-crenatis papyraceis utrobique glabris supra nitidis necnon prominenter reticulatis subtus pallidioribus; *fasciculis* paucifloris quam folia brevioribus glabris; *pedicellis* filiformibus quam drupæ brevioribus; *calycis* glabri segmentis triangulari-oblongis acutiusculis quam petala ovato-oblonga obtusa paullo brevioribus; *drupis* subglobosis glabris.

Transvaal, "The Downs,' Pietersberg Division, 22033.

Foliola lateralia 2–3 × 1·5–2·5 cm., fol. terminale 3·5 × 1·5–3·3 cm.; petioli plerique 1·5–2·5 cm. long. Paniculæ ± 2 cm. long., nonnumquam usque 5–10 mm. reductæ. Bracteolæ filiformes, circa 1 mm. long. Calycis segmenta ·75 mm., petala ægre 1 mm. long. Drupa sicca 3 mm. humectata 4 mm. diam.

To be inserted next *R. pyroides* Burch., which has, *inter alia*, relatively narrower hairy leaflets without the prominent reticulation, much longer panicles, and hairy flowers.

COMBRETACEÆ.

Combretum (§ *Angustimarginatæ*) **griseiflorum**, sp. nov. Verisimiliter frutex, *foliis* oppositis suboppositis vel sparsis breviter petiolatis oblongo-lanceolatis oblongisve obtusis basi cuneatis papyraceis utrobique sed præsertim pag. inf. argenteo-lepidotis costis lateralibus utrinque 7–8 sub margine arcuatis uti costa centralis pag. sup. planis inf. optime eminentibus; *spicis* sublaxe plurifloris foliis brevioribus rhachi puberula; *bracteis* parvulis anguste linearibus diutule persistentibus; *ovario* sessili subcylindrico dense griseo-tomentoso; *calyce* campanulato 4-lobo extus tomentoso lobis late triangularibus obtusissimis; *petalis* suborbicularibus dorso pubescentibus margine calvis stamina fere semiæquantibus; *disco* late cyathiformi margine angusto libero longe villoso.

Transvaal, Nelspruit; *H. G. Breyer* (Hb. Rogers, 24018).

Folia pleraque 5–9 × 2–3·5 cm., in sicco viridia subtus pallidiora.

Spicæ evolutæ 4–6 cm. long., bracteæ circa 1 mm. Ovarium humectatum (cum receptaculo inf.) vix 4 mm. long. Calyx 2 × 3 mm.; hujus lobi ·75 mm. long. Petala suborbicularia, 1 mm. long. Stamina 2–5 mm. long.

The lax racemes with grey-tomentose ovaries are the chief points of difference from species of this section.

RHIZOPHORACEÆ.

Dactylopetalum Rogersii, sp. nov. Planta *ramulis* inferne subteretibus superne compressis ad nodos aliquantulum nodulosis longitrorsum striatis glabris; *foliis* petiolatis ovato-oblongis obtusis vel obtussissimis basi obtusis tenuiter coriaceis glabris pag. utraque eminenter reticulato-nervosis; *floribus* 5-meris in axillis pluribus breviter pellicellatis; *calycis* glabri tubo cylindrico quam lobi triangulares obtusi vel obtusissimi 3-plo longiore; *petalis* lineari-spathulatis apice plurifimbriatis; *staminibus* 10 petalis æquilongis filamentis glabris antheris oblongo-ovoideis obtusis glabris; *disco* annulari; *ovario* subgloboso glabro 2-loculari 4-ovulato.

Belgian Congo, Elisabethville, 26209. Folia 8–11 × 3–5 cm.

Pedicelli circa 1·5 mm. long. Calyx in toto 5 × 3·5 mm.; hujus lobi soli 1·25 mm. long. Petala 5 mm. long., inferne ·5 mm. lat., superne usque 1 mm. ampliata (fimbriis neglectis). Filamenta 5 mm. long., antheræ 1 mm. Ovarium 3 × 2·25 mm. Stylus vix 5 mm. long.

Differs from *D. Mannii* chiefly in the few-flowered inflorescences, the short pedicels to the 5-merous (not 4-merous) flowers, and the cylindrical calyx.

ANISOPHYLLEA TOMENTOSA Rolfe. Elisabethville, 26300.

MOLLUGINACEÆ.

Tribulocarpus, gen. nov. Flores polygami. Fll. ♂: *calycis* tubus abbreviatus, limbo 5-partito lobis imbricatis; fll. ☿ *calyx* uti ♂ sed major necnon tubo cylindrico elongato præditus. *Petala* 0. *Stamina* ∞, calycis ori inserta; filamenta basi connata. Fll. ☿ *ovarium* inferum, cum axi florali continuum, bracteis obtectum, 2-loculare. *Stylus* 2-ramosus. Ovula solitaria, pendula. *Fructus* plerumque compositus, lignosus, eum *Tribuli* alicujus spinosi referens, bracteis induratis spinescentibus arcte indutus. *Semina* testa crustacea circumdata: embryo curvatus albumen sparsum cingens.—— *Suffrutex* farinosus. *Folia* alterna, obovata. *Stipulæ* 0. *Flores* in capitulos pedunculatos oliganthos digesti, superiores (interdum omnes vel fere omnes?) ☿, pauci laterales ♂.

T. dimorphantha, sp. unica (*Tetragonia dimorphantha* Pax in Engl. Bot. Jahrb. x. 12. tab. ii.

S.W. Africa, between Windhuk and Walfisch Bay; *E. G. K. Esdaile* (Hb. Rogers, 15318, 15319). Stringbank; *id.* (Hb. Rogers, 15372).

Pax describes the inflorescence as consisting of a central ☿ flower and 3–4 lateral ♂ ones. Archdeacon Rogers's material does not bear out this statement, for whereas an occasional inflorescence may conform to Pax's description, in most cases examined the ☿ flowers were two or more in number and occasionally all or almost all were ☿. In any event the fruit is undoubtedly a compound one, and therefore the plant cannot properly be considered a *Tetragonia*. To what extent the axis forms part of the ripe fruit is uncertain, but there seems no reason to doubt that the spines are really bracts enlarged and lignified. Study of this plant from plenty of well-preserved material should yield interesting results.

There is in the British Museum a specimen of Een's collecting (comm. 1879), which, if not conspecific with this, must be a second species of the genus. Except for the larger and broader leaves the two agree fairly well; but the specimen is but a small one in early flower, so that a satisfactory conclusion is out of the question.

RUBIACEÆ.

Oldenlandia Rogersii, sp. nov. Planta humilis copiose ramosa; *caule* gracili repente radicanteque hac atque illac ramos ascendentes abunde foliosos glabros emittente; *foliis* parvis brevipetiolatis ovatis obtuse acutis obscure trinervibus glabris; *stipulis* a basi lata in setas perpaucas exeuntibus; *floribus* 4-meris pedicellatis in cymas terminales paucifloras subcongestas vel paullo laxiores digestis; *ovario* anguste campanulato uti calycis segmenta ovato-lanceolata acuta quam se ipsum paullulum longiora glabro; *corollæ* calycem breviter excedentis tubo late cylindrico intus ore villoso quam lobi ovato-lanceolati obtusiusculi paullo breviore; *antheris* inclusis subsessilibus; *stylo* exserto sub apice puberulo; *capsula* —.

Transvaal, Grasskop, Lydenburg, 14857.

Folia pleraque 6–10 × 5–8 mm., in sicco supra brunnea subtus griseo-luteola. Stipulæ 2 mm. long.; harum basis indivisa ·25 mm. Pedicelli 1–2 mm. long. Ovarium 1·25 mm.; calycis segmenta 1·75 mm. long. Corolla 4·5 mm. long. Antheræ ovoideo-oblongæ, acutæ, ægre 1 mm. long. Stylus 5 mm. long.; hujus rami obtusi ·5 mm. long.

Much like *O. Oliveriana* K. Schum., which has larger and differently-shaped calyx segments, corolla with longer and relatively narrower tube and larger lobes, and entirely different stamens.

COMPOSITÆ.

Felicia homochroma, sp. nov. Planta herbacea bispithamea, *caule* erecto fere a basi ramoso ramis crebris erectis teretibus foliosis longitrorsum costatis puberulis; *foliis* sessilibus linearibus obtusis integris vel subobsolete denticulatis leviter scabriusculis; *capitulis* mediocribus campanulatis ramulos breves solitatim terminantibus; *involucri* glabri phyllis 3-serialibus lineari-lanceolatis acutis intimis quam reliqua facile longioribus sursumque coloratis; *ligulis* paucis abbreviatis oblongis 3-denticulatis luteis; *disci* corollis anguste cylindricis; *achæniis* oblongis compressis faciebus planis sparsim sericeis; *pappi* setis 1-seriatis caducis scabriusculis albis.

Belgian Congo, Elisabethville, 26220.

Folia majora ± 2 cm. long., 1 mm. lat. vel paullo ultra, folia minora tenuiora, ± 1 cm. long. Ramuli fertiles plerumque 1–2 cm. long., nudi vel foliis paucis parvulis onusti. Capitula pansa circa 8 mm. diam. Involucri phylla ext. 1·5 3 mm., intima 5 mm. long. Ligulæ fere 2 mm. long.; ·5 mm. lat. Disci corollæ 4 × ·45 mm. Achænia pallida, 1·25 × ·5 mm. Pappus circa 4 mm. long.

This is quite different in foliage and inflorescence from *F. lutea* N. E. Br.

HELICHRYSUM SWYNNERTONII S. Moore. Transvaal, Kaapsche Hoop, 24024. Now first noted as a South African plant. There is a specimen at Kew from the Drakensburg Range; *Bolus*, 7809.

Euryops neptunicus, sp. nov. Planta glabra, *caule* sat robusto paullo supra solum in ramos 2–4 erectos foliosos exeunte; *foliis* erectis arcte imbricatis angustissime linearibus prope medium trifurcatis segmentis filiformibus inter sese æquilongis; *pedunculo* unico laterali maxime elongato; *involucri* phyllis 11 basi connatis ovato-oblongis acutis uninervibus; *flosculis* exsertis; *ligulis* abbreviatis oblongis brevissime 3-denticulatis perspicue 4-nervibus; *disci* corollis inferne cylindricis superne anguste campanulatis; *antheris* basi minutissime auriculatis; *achæniis* late cylindricis 10-costatis minute pubescentibus; *pappi* setis paucis brevibus caducissimis.

Transvaal, Kaapsche Hoop; *H. Wager* (Hb. Rogers, 24007).

Planta pedunculo exempto infraspithamea. Folia pleraque usque ad furcam 5–10 mm. long., ·25–·5 mm. lat.; lobi circa 7 mm. long. Pedunculus 17–20 cm. long. Capitula pansa circa 12 mm. diam. Involucri phylla 3–4 mm. long. Ligulæ ægre 5 × 1·5 mm.; disci corollæ 3 mm. long. Achænia 2 mm. long. vel paullulum ultra; pappi setæ summum ·5 mm. long.

Evidently near *E. tenuilobus* N. E. Br., which *inter alia* has pinnately divided leaves and smaller flowering heads on shorter peduncles. The trivial name was suggested by the 3-forked leaves.

Senecio (§ *Sinuosi*) **Breyeri**, sp. nov. Usque bispithamea, *caule* ascendente a basi folioso glanduloso-puberulo; *foliis* infimis radicalibus quam reliqua majoribus oblongis sessilibus obtusis basi auriculatis (junioribus gradatim brevioribus amplexicaulibus summis linearibus acutis) integris vel fere integris nisi dentato-pinnatifidis leviter puberulis; *capitulis* submediocribus homogamis discoideis campanulatis ∞-flosculosis in corymbum oligocephalum laxum folia longe excedentem breviter hispidulo-scabridum digestis; *involucri* phyllis 14–16 linearibus acuminatis apice sæpe recurvis margine angustissime membranaceis dorso scabiusculis adjectis perpaucis parvis calyculum efficientibus; *flosculis* exsertis luteis; *corollæ* tubo infundibulari quam lobi plane longiore; *styli* ramis truncatis penicillatis; *achæniis* linearibus apice breviter angustatis subteretibus obscure costatis minutissime puberulis; *pappi* setis glabris albis.

Transvaal, Nelspruit, Barberton; *H. G. Breyer* (Hb. Rogers, 24019).

Folia inferiora 3–6 × ·5–1 cm., superiora ± 2 cm. × 2 mm., summa in bracteas inflorescentiæ ± 5 mm. long. transeuntia. Inflorescentia circa 10 cm. long., ± 6·5 cm. diam. Pedunculi proprii ± 1 cm. long., bracteis perpaucis minimis onusti. Capitula 7 × 7 mm. Involucri phylla 4 mm. long. Corollæ 5·5 mm., achænia 2 mm., pappus 4 mm. long.

Affinity with *S. serratus* Sond., which among other features has much larger heads on longer proper peduncles.

No. 19852 from Premier Mine, Pretoria, is conspecific with this.

Senecio (§ *Leptolobi* ?) **waterbergensis**, sp. n. Planta glabra, *caule* bispithameo erecto omnimodo folioso; *foliis* radicalibus—— caulinis parvis sessilibus pinnatifidis (segmentis oblongis vel linearibus obtusis) inferioribus confertis superioribus sparsis summis imminutis in inflorescentiæ bracteas transeuntibus; *capitulis* heterogamis radiatis ∞-flosculosis corymbum oligocephalum laxum folia multo excedentem referentibus; *involucri* campanulati phyllis fere 30 subbiseriatis oblongis acuminatis dorso carinatis calyculi phyllis perpaucis anguste linearibus; *ligulis* circa 12 exsertis oblongis apice 3-denticulatis luteis; *flosculis* disci breviter exsertis; *styli* ramis truncatis penicillatis; *achæniis* cylindricis paucicostatis puberulis; *pappi* setis paucis caducis scabriusculis albis.

Transvaal, Leeuwpoort, Waterberg, 24027.

Folia inf. pleraque 2–3 cm. long.; horum segmenta integra vel dentata plerumque 2–5 mm. long. Inflorescentiæ 10–15 × 4–5 cm. Pedunculi proprii erecti, 5–9 cm. long.; horum bracteæ tenues 1·5–4·5 mm. long. Capitula pansa 7 × 9 mm. Ligulæ 4 mm. long. Disci corollæ anguste infundibulares, 4 mm. long. Achænia (cruda) 1·25 mm., pappi setæ usque 4 mm. long.

Apparently nearest *S. pinnulatus* DC., differing chiefly in the broader lobes to the leaves, the long proper peduncles, and the more numerous and acuminate involucral leaves.

DICOMA KIRKII Harv. var. MICROCEPHALUS, var. nov. A typo abhorret non nisi capitulis minoribus, 2 cm. long., 1·5 cm. lat.

Transvaal, Talc mine, Barberton; *Thorncroft*, 1074.

CENTAUREA GOETZIANA O. Hoffm. Belgian Congo, Sakania, 26400.

ASCLEPIADACEÆ.

Schizoglossum Theileri, sp. nov. Verisimiliter scandens, *caule* simplici folioso hispidulo-puberulo; *foliis* petiolatis lanceolatis acutis basi late truncatis nonnunquam levissime hastulatis membranaceis pag. utravis scabriusculis margine breviter indurateque ciliatis; *umbella* unica solum obvia interaxillari pauciflora pedunculata pedunculo foliis breviore uti bracteæ pedicellique hispidulo insidente; *bracteis* elongatis linearibus; *pedicellis* quam flores plane longioribus; *calycis* segmentis oblongo-lanceolatis acutis dorso piloso-hispidulis; *corollæ* alte divisæ lobis calyce longioribus oblongo-lanceolatis obtusis glabris; *coronæ* phyllis a corolla breviter superatis linguæformibus obtusissimis intus carinis 2 elevatis membranaceis percursis addita juxta medium crista parva erosa; *gynostegio* coronæ phyllis multo breviore: *antherarum* appendice parva rotundata inflexa; *polliniis* oblongo-pyriformibus quam caudiculæ longioribus; *stigmate* apice depresso.

Transvaal, Griffin mine, Pietersburg Division; *A. Theiler* (Hb. Rogers, 23996).

Folia pleraque 7·5–9 cm. long., majora basi 2–3 cm. paullo infra apicem 5–7 mm. lat.; exstant folia minora raro usque 3 cm. diminuta; petioli 4–8 mm. long. Pedunculus 4·5 cm. long. Bracteæ usque 15 mm. long., sed plerumque breviores sc. 5–10 mm. Pedicelli 8–9 mm. long. Calycis segmenta 3·5 mm., corollæ lobi 6 mm., coronæ phylla 4 mm. long. Gynostegium 2·25 mm. alt. Pollinia fere 1 mm. long.

The lanceolate broad-based leaves, coupled with the relatively long coronal leaves ending bluntly and without an inflexed point, serve to distinguish this plant, which does not seem closely allied to any congener.

SELAGINACEÆ.

Selago Stewartii, sp. nov. Herba sesquispithamea verisimiliter perennis; *caule* erecto simplici vel ramoso uti rami crebro foliosi subtiliter scabriusculo-puberulo; *foliis* plus minus fasciculatis ascendentibus sessilibus linearibus obtusis margine revolutis scabriusculis; *capitulis* terminalibus solitariis vel perpaucis ad apicem ramorum corymbosis densifloris floribus subsessilibus; *bracteis* foliis junioribus similibus nisi paullulum minoribus; *calyce* bracteas facile superante subcylindrico (superne paullo ampliato) 5-carinato subtiliter puberulo tubo quam lobi triangulares acutiusculi multo longiore; *corollæ* tubo calycem excedente anguste infundibulari lobis tubo duplo brevioribus late oblongis vel oblongo-obovatis obtusissimis; *antheris* superioribus subexsertis inferioribus inclusis.

Swaziland; *M. Stewart* (Hb. Rogers, 20144).

Folia majora 10–15 mm. long., 1 mm. lat., minora ± 7 mm. long., ultima in bracteas transeuntia. Capitula 1·5 cm. diam. Bracteæ 3–4·5 mm. long. Calyx 5–6 mm. long., basi 1·5 mm., ore 1·2 mm. lat.; lobi vix 1 mm. long. Corollæ tubus 7 mm. long., inferne ·75 mm., ore 1·2 mm. lat.; lobi 1·5–2·5 mm. long. Filamenta 1·5 mm., antheræ ·5 mm. long. Stylus exsertus.

Appearance much of *S. Junodi* Rolfe, but the flowers are different in several respects.

EUPHORBIACEÆ.

EUPHORBIA ESPINOSA Pax. South Rhodesia, Wankie, 13420.

E. KNUTHII Pax. Portuguese East Africa, Mallana, 22482.

PAIVÆUSA, sp. nov. Archdeacon Rogers found at Elisabethville (No. 26200) a fruiting specimen belonging to this hitherto monotypic Angolan genus. Although certainly different from *P. dasyphylla* Welw., in the absence of flowers it has been thought better not to describe it.

(To be continued.)

THE VIENNA CODE.

[In the course of a review (*Torreya*, 1919, 244–6; 1919) of Hitchcock and Standley's *Flora of Columbia*, Dr. Britton attacks the constitution of the Vienna Botanical Congress, at which "the so-called International Code" of botanic nomenclature was adopted. In a footnote to the account of the Gray Herbarium Expedition to Nova Scotia (1920) which Mr. M. L. Fernald is publishing in *Rhodora* (May, pp. 106–7), he defends the constitution of the Congress against Dr. Britton's attack; the analysis which he gives seems of sufficient interest to justify reprinting, especially as, so far as we know, no similar analysis has hitherto been published.—Ed. Journ. Bot.]

"Dr. Britton . . . refers to the International Rules of Botanical Nomenclature as 'forced down the throats of the Vienna Botanical Congress by a German majority, and further manipulated by the same majority at the Brussels Congress,' while the American Code 'cuts out autocracy.'

"Such remarks from one of the original Commissioners who organized the Vienna Congress, but who has treated the rulings of its tremendous international majority as 'a scrap of paper,' must seem like a huge joke to anyone familiar with the methods by which the American Code originated. The Nomenclatorial Congress at Vienna was presided over by Flahaut, of Montpellier (although Dr. Britton had nominated von Wettstein), with Briquet, of Geneva, as *rapporteur général* (certainly neither of them Germans). There were 39 Commissioners: 4 of them from Germany, 3 from Austria and 2 from Hungary; while the remaining 30 were from non-German countries (1 from Uruguay, 2 from Belgium, 1 from Spain and Portugal, 4 from the United States, 4 from France, 4 from the British Empire, 2 from Holland, 3 from Italy, 4 from Russia, 1 from Sweden, and 4 from Switzerland); surely not a German majority. Nineteen authors of formally proposed motions were present, each with a single vote: 7 of them from Germany, Austria and Hungary, the remaining 12 from the United States, Switzerland, Russia, Norway, Italy, Great Britain and France; again not a *German* majority. Forty-five botanical institutions, each with a single vote, were represented: 6 German, 5 Austrian, 2 Hungarian (total 13); while the remaining 32 votes came from the following countries: Belgium 1, Denmark 1, United States 10, France 3, Great Britain 2, Holland 2, Italy 5, Norway 1, Russia 1, Sweden 3, and Switzerland 3 (total 32, opposed to 13); again not a German majority! Seventy-two societies and academies had delegates with a total of 135 votes distributed as follows: Germany 23, Austria 9, Hungary 3 (total 35 out of 135), not an overwhelming German majority; Belgium 3, Denmark 3, Spain 4, United States 18, France 29 (more than Germany!), Great Britain 12, Holland 9, Italy 4, Norway 1, Russia 6, Sweden 2, and Switzerland 9 (total 100).

"Article 20 of the International Rules, recognizing *nomina conservanda* (Art. 17*ter* of the Texte Synoptique voted upon at Vienna), the Article so offensive to certain Americans, was adopted at Vienna by a vote of 133 to 36 (a majority greatly exceeding the Germanic vote), and the Commission appointed to decide on the list of *nomina conservanda* consisted of Bonnet (French), Britton (America), Harms (German), Prain (British), and Briquet (Swiss)—again far from a *German* majority.

"The same situation is obvious to anyone who sufficiently cares for the facts to read the records of the Brussels Conference. Flahaut (French) was again president, with de Wildemann (Belgium) general secretary. Of the 54 members of the Permanent Bureau and the Commission on Nomenclature, 12 were Germans, Austrians and Hungarians; 42 non-Germans. Of the 15 authors of motions present and voting, 4 were German, Austrian and Hungarian; the others (11) non-German. Of the 50 botanical establishments having votes 12 were German, Austrian and Hungarian; 38 not. Of the 108 votes by delegates from Academies and Societies, 30 were cast by Germans, Austrians and Hungarians; 78 by representatives of other countries (including 19 American, 20 French, and 15 British). That these facts, which are simple transcriptions from the official published records of the Congresses, most certainly do not represent the 'autocracy' of an overwhelming 'German majority' should be evident to everyone. For many years prior to the Vienna Congress tremendous effort was expended by those who sincerely wished to bring uniformity out of the very diverse usages of local groups of botanists. The effective foundation work laid at Paris (German?) was subsequently carried forward with unlimited self-sacrifice and far-seeing skill by Briquet, Flahaut, Rendle and others; and the sportsmanlike or statesmanlike spirit with which the vast majority of delegates, representing all sorts of pet views, abandoned their private wishes at Vienna is one of the most impressive signs that, although a few 'Neo-Americans' present were unwilling to concede anything, the botanists of the rest of the world were working disinterestedly for agreement."

SHORT NOTES.

Orchis prætermissa Druce and O. purpurella Stephenson. In an article in *De Levende Natuur* (Amsterdam) for June, M. Sipkes has dealt with these species. The former he has found in several stations in Holland and Zealand. He had previously assigned it, somewhat dubiously, on account of its affinities with *O. incarnata*, to *O. latifolia*; a form at Heille with a long, narrow extension of the lip which he named *O. latifolia* v. *macrantha* he now names *O. prætermissa* v. *macrantha*. A short description of the species is appended. At the close of the present season many more stations in Holland will certainly be recorded. *O. purpurella* has been observed near Epen in South Limburg, and near Alkmaar in Gelderland. M. Sipkes says that it flowers early, being over by the end of May. He believes it is distinct from *O. cruenta*, which flowers later. As to *O. latifolia*, he thinks that in Holland it may be all or nearly *purpurella* hybrids, but leaves the question open for the present.—T. & T. A. Stephenson.

HYDRILLA VERTICILLATA Casp. [We take the following from the recent Report of the Watson Exchange Club, which is noticed on p. 238. The plant was "first discovered [in Esthwaite Water, N. Lancashire] in 1914, and is now more abundant than formerly."]

"Grows with *Naias flexilis*, *Pot. panormitanus*, *P. Sturrockii*, *Callitriche autumnalis*, etc., at a depth of six to eight feet, invisible from the surface, under a light-intensity of ·05 to ·03 of full daylight. Light does not entirely control its distribution however, for it is only found where the mud is inorganic, blue-grey in colour and clayey in texture, and containing less than 15 per cent. of organic matter. It propagates itself here solely by means of winter buds; no flowers have been seen, although carefully sought for for six years. The nearest place where it is known to occur is in Pomerania, 700 miles due east. It is conceivable that ducks, driven westward by the colder winters of that country, alighted on this private and secluded water with winter-buds adhering to their feathers or feet. This is supported by the fact that the extensive reed-swamps on the lake-margin still shelter great numbers of wild fowl of many species. The lake drains into Windermere, less than two miles distant; but so far we have not been able to find the plant there. This however, is not surprising, for the conditions under which plants live in the two lakes are very dissimilar. Plants on the lake-floor in Esthwaite are invisible at four feet, but easily recognised in Windermere at twelve feet (and objects of light colour up to twenty feet), while the quantity of silt in the former is much greater than in the latter, and essentially different in character. (See Journ. Ecol., Dec. 1917.)"—W. H. PEARSALL.

GLOSTERSHIRE PLANTS. I have recently had nice specimens of *Trifolium subterraneum* sent me from near Tewkesbury with *T. filiforme*; the only previous record which I have from v.c. 33 is from a garden near Cheltenham: probably a lawn plant. *Cardamine impatiens* is also found in the Tewkesbury neighbourhood. From several places, both in v.c. 33 and in v.c. 34, an *Orobanche* has been sent which agrees well with *O. minor* var. *flavescens* in its colour. It has the *minor* tube and stigma, and is highly glandular, not with the jointed glandular hairs of some species but with simple rigid hairs tipped with yellow glands. In all cases (in Glos.) it has been found along with ordinary *minor*. *Carex tomentosa* has been found in Hailey Wood, Cirencester, in very small quantity with *C. pallescens*: also in a dry field between Barnsley and Bibury.—H. J. RIDDELSDELL.

SPARGANIUM ANGUSTIFOLIUM Michx. In a recent letter Mr. M. L. Fernald, of the Gray Herbarium, Mass., U.S.A., writes: "There is no possible question that Michaux's plant is the same as *Sparganium affine* Schnizl. I examined the material at Paris in 1903, and there is no doubt about the matter." In 1851 Babington (Man. Brit. Bot. ed. 3, 338) first mentions *S. affine* under *S. natans* L. with a reference to Fries, Sum. Veg. Scand. 559 (supp.) (1846). In the same year Syme (Bot. Gaz. iii. 157), under *S. natans* "L." Fries, says that Don in the herbarium of Dr. Fleming (1808) named the plant *S. longifolium* (not *S. longifolium* Turcz. (1838) a Siberian plant). Gray (Man. Bot. N. U.S. ed. 4, 430; 1866) remarks under *S. natans* L. var. *affine* Fries, "this may be *S. angustifolium* of Michaux, as is generally thought, but Fries assigns this to the next." In the fifth edition (1879) p. 481, under *S. simplex* Huds. var. *angustifolium*, Gray quotes "*S. angustifolium* Michx. *S. affine* Schnizlein." In 1888 Morong (Bull. Torr. Bot. Club, 79) remarks: "Engelman has seen Michaux's specimen at Paris, and it is the same as *affine*." Britton (Man. Fl. N. States, 1901, p. 40) has "*S. simplex angustifolium* (Michx.) Engelm." but does not name *affine*. Schnizlein's plant dates from 1845 (Nat. Pfl. Fam. d. *Typhææ*), Michaux's from 1803—Fl. Bor. Am. ii. 189. A revision of the American plants which have been confused with *S. simplex* is given in *Rhodora*, ix. 87–9 (1917). In the last ed. of Bab. Man. (edited by Messrs. Groves) (1904, p. 433) the name *S. natans* L. is still used and made synonymous with *affine*. The latest Swedish Flora (Lindman, pp. 43–44; 1918) regards *S. natans* L. as in part *S. affine*, and restricts *S. natans* L. to *S. Friesii* Beurling. Neuman (Sveriges Flora, 808; 1901) has *S. natans* (L.) Fr.; while in his account of the genus in Hartman's Handb. Sk. Fl. 1889 he has "*S. natans* L. Sp. Pl. ed. 2. 1763? E. Fr. Summ. 1849 = *S. Friesii* Beurl. Bot. Not. 136 (1854)." It seems that for our plant we must use Michaux's name *affine*.—A. BENNETT.

REVIEWS.

Two Text-Books.

A Text-book of Botany for Medical and Pharmaceutical Students. By JAMES SMALL, D.Sc., F.L.S. 8vo, pp. x, 681, with 1350 illustrations. Churchill, London, 1921. Price 25*s*.

The Elements of Vegetable Histology. By C. W. BALLARD. 8vo, pp. xiv, 246, with 75 text-figures. Willey, New York; Chapman & Hall, London; 1921. Price 17*s*. 6*d*.

EACH of these volumes has been prepared to meet the needs of a special class of student by a teacher who has had special experience. Prof. Small, of the Queen's University, Belfast, was until recently Lecturer in Botany to the Pharmaceutical Society of Great Britain; and Mr. C. W. Ballard is Associate Professor of Materia Medica and Director of the Microscopical Laboratory, College of Pharmacy, Columbia University. Each author should therefore be in a position to judge of the needs of the students for whom he is writing.

Professor Small's text-book has grown out of the late Prof. Reynolds Green's *Manual of Botany*, which in turn replaced the earlier work by Prof. Bentley. The excellent figures, especially those illustrating the external morphology of the flower and fruit, were an important feature of the two earlier works, and these have been retained in the present volume with additions from various sources and some original. At a rough estimate the figures occupy half the space of the volume, and into the other half Prof. Small has got together a large amount of information. The first part, occupying nearly two-thirds of the whole, supplies a good elementary account of the structure of a plant and its parts, and of its functions. An excellent little introduction is afforded by the story of the life-history of the Dandelion. The second part deals with classification, and, as often happens in general text-books, the author has collected a great many facts within a small compass. Occasionally Prof. Small would seem to go beyond the needs of the elementary student—his comparatively long discussion of phyllotaxis and the introduction of the spiral is a case in point; and parental affection could not resist the introduction of the family tree of the Compositæ—but we are sorry for the student! There are three brief appendixes; the first deals with the diagnostic characters of certain medicinal or poisonous plants; the second supplies a scheme for the technical description of a flowering plant; and the third gives tests for tissues and various plant substances with brief directions for staining.

Mr. Ballard's work is intended for beginners, and is an introduction to the study of plant-structure with the aid of the microscope. It forms a suggestive course for a teacher. The author describes in some detail general methods of preparation and mounting of specimens, including the use of the microtome; this is followed by a chapter explanatory of the microscope and its use. The chemical properties of cell-walls and cell-contents are then considered, and a chapter follows on the use of stains. The remaining chapters deal with the chief characters of the plant-cell, of the various tissues, and of the structure of the principal plant organs. The subject-matter is concise and the book is very clearly printed. The illustrations, most of which are original, are somewhat crude but quite clear.

A. B. R.

Germination in its Electrical Aspect. By E. A. BAINES. Pp. xx + 185; with 130 text-figures. 12*s.* 6*d.* net. Routledge: London, 1921.

MANY minor "facts" are given in this volume which require revision. The author seems to regard as altogether negligible Shiro Tashiro's striking demonstration of the production of carbon dioxide by all dry and viable seeds. It seems advisable, however, to consider his main thesis concerning germination.

According to the author (p. 30)—"the fundamental principle governing the germination of a seed is this"—the seed must become in effect a Leyden jar, and receive a continuous charge of electricity before it will germinate. He describes an experiment in which the insulating inner membrane of several acorns was perforated (pp. 34–35). Only in one case did germination occur and "it gave me a very bad quarter of an hour, for . . . . it seemed . . . . to be subversive of my theory of electrostatic action and to render all my work abortive." He proceeds (p. 35) to explain the exception by repair of the insulation, and says "the insulation of the seed must be intact if germination is to take place." From the author's record of his feelings with one exceptional germination, one would imagine that if he had done as the reviewer did on reading this statement—had taken eight broad beans stripped carefully of all seed-coat, planted them in moist garden-soil, and obtained good germination in *every* case—the book would never have been written. Further, if, as we have done, the author had germinated hundreds of broad beans pinned right through with two pins to a piece of wood over which water from a tap was flowing, the very idea of developing any theory of electrical insulation as an essential factor in germination would never have occurred to him.

There are many interesting quotations and some experimental results on general growth after germination which do not seem open to question. Electrical theories of sleep, hearing, and cancer are also suggested. The author maintains that the leaves of plants take in from the air a force, not electricity but something which suggests to the reader the vital force or *Prana* of the Yogis, and that in this way the normal polarity of plants is developed, the air being positive and the earth negative. Taken simply as electrical force there is some independent evidence that this may be a partial explanation of plant polarity.

J. S.

BOOK-NOTES, NEWS, ETC.

THE Report of the Watson Exchange Club for 1920–21 contains, as usual, numerous notes of interest on the plants received, contributed chiefly by Messrs. C. E. Salmon, A. Bennett, W. H. Pearsall, J. W. White, H. J. Riddelsdell (Rubi), H. W. Pugsley (*Hieracium*), and the Editor, Mr. H. S. Thompson. The notes are preceded by "Hints on Collecting and Mounting Linear-leaved Aquatics," by Mr. W. H. Pearsall, which by the courtesy of the Editor we are reprinting, as well as the note on *Hydrilla* by the same writer (p. 235). On a "very small-leaved prostrate *Erodium* from Glamorganshire," Messrs. Salmon and Baker write:—"It is a pity the collector made no note of the colour of floral parts and other details (as suggested in Journ. Bot. 1920, 126) before drying this example. As far as we can gather from the single specimen submitted, this comes under *E. glutinosum* Dum. (less glandular than usual), having the ± bipinnatifid leaves, short, few-flowered peduncles, sub-dentate filament, and small carpel-pit without the furrow, etc., of that species. We should like, however, to see better material before definitely committing ourselves to this name."

THE *Kew Bulletin* (1921, no. 4) is largely occupied by a continuation of Mr. W. B. Grove's revision of the doubtful species of *Phoma* which were included in the third volume of Saccardo's *Sylloge*. "By this means, and by the labours of von Höhnel and other workers, the genus has been relieved of many species referred to it by the older mycologists, who regarded it as a convenient receptacle for doubtful forms: the genus *Macrophoma* has almost disappeared." The investigation, which is very thorough, contains full descriptions of many of the species, and involves the necessary creation of several new combinations; it is illustrated by figures in the text; the typographical arrangement is new and somewhat startling. The number also contains figures and descriptions of three species of a new genus of *Apocynaceæ*—*Daturicarpa*—established by Dr. Stapf on plants collected in Belgian Congo. Mr. James Hendrick writes on "The Composition of the Rhizomes of Bracken and its Variations."

In the serial publication, *Herbarium*, issued by T. O. Weigel in Leipzig, which is mainly devoted to the sale of exsiccata, there is now being published a "Conspectus Cyperacearum in America meridionali nascentium enumeratæ a H. Pfeiffer, Bremen." The work is evidently done with much care, and we regret that it should not be published in some more definitely botanical publication; as it is, it is in danger of being overlooked, on which account we call attention to it. The portion now being printed, in which new species are described and new combinations made, deals with *Heleocharis*. The numbers bear no date beyond that of 1921, and accurate citation is thus impossible.

The *Bulletin of the Torrey Club* for May contains an interesting paper by W. L. McAtee "On *Viburnum* and the assemblage *Caprifoliaceæ*." After careful examination he regards as insufficient the characters which have been relied upon as separating *Caprifoliaceæ* from *Rubiaceæ*—a view in support of which he cites Baillon, K. Schumann, and Fritsch. "The *Caprifoliaceæ* cannot pass a test which should leave any satisfactory plant family intact, and with all due respect to those most erudite botanists, Bentham and Hooker, it would appear that their statement that the *Caprifoliaceæ* are a very natural order was made without sufficient consideration."

In the *Gardeners' Chronicle* for July **2** Mr. W. R. Dymes describes and figures *Iris acutikor*, an interesting and attractive hybrid produced by fertilizing the flowers of *I. acutiloba* with the pollen of *I. Korolkowi*.

In *Notes from the Royal Botanic Garden, Edinburgh* (xii. no. lx.: it would be better to employ Arabic numerals in the latter case), Dr. Malcolm Wilson describes and figures *Æcidium sino-rhododendri* and *Labridium Rhododendri*, two new fungi from Tibet. The number also contains an interesting account of the Royal Botanic Garden, with a list of the Regius Keepers since its foundation, which dates from 1699, and of the principal gardeners since 1756.

Mr. Oliver A. Farwell's latest effort in resuscitation is that of *Mondo*, which is cited by Adanson (ii. 496) from Kaempfer. It "antedates Ophiopogon by 44 years, and since the latter is not a 'nomen conservanda' [*sic*] it must be displaced by the earlier name." The matter is of some interest, as *Mondo* has hitherto been regarded as a synonym of *Carex*. Thirteen new combinations of the literary kind follow—there is no evidence that any of the species have been examined. The paper appeared in the *American Midland Naturalist*, but the extract sent us gives no date.

Records of the Botanical Survey of India (vi. n. 9) contains a list, with notes and native names, of the "Useful Plants of the District of Lakhimpur in Assam," by Humphrey G. Carter, M.B., Economic Botanist to the Survey, and Mrs. Carter.

The new instalment (iii. pt. 2) of Mr. J. F. Duthie's *Flora of the Upper Gangetic Plain* includes the orders *Coniferæ* to *Juncaceæ*. The author describes as new a *Habenaria* (*H. graveolens*) which he had previously referred to *H. digitata* Lindl.

The Oxford University Press announces the publication of an important work on *The Silviculture of Indian Trees* by R. S. Troup. It will be in three quarto volumes, fully illustrated by plates (some in colour) and figures in the text; the arrangement will follow that of Bentham and Hooker.

The New Phytologist (xx. n. 2: June 30) contains papers on "Permeability," by Walter Stiles; "Stomata and Hydathodes in *Campanula rotundifolia* L., and their relation to Environment," by Margaret W. Rea; "The Hydrion Differentiation Theory of Geotropism," by James Small; "The Grouping of Vascular Plants," by Margaret Benson, who also contributes a "Note on a Numerical Sequence of Plant Families."

Science Progress for July contains a paper on "Natural Indigo," by W. R. G. Atkins, "some time Indigo Research Botanist to the Government of India," the usual quarterly summaries of work in Botany and Plant Physiology, and a notice of A. G. Nathorst (1850–1921) by Dr. Marie Stopes. We are glad to note an improvement in the page-headings, which now give useful information.

We are glad to note that arrangements have been made for carrying on *The Orchid Review*, under the editorship of Mr. Gurney Wilson, F.L.S. The first number of the new volume appeared in July; it contains among other things a portrait of the late editor with a notice by Dr. Stapf; an article on Sir Trevor Lawrence's collection of Orchid paintings; a note on "Orchid Fungus"; and much useful and varied information.

Newspaper Botany.—The *Observer* (April 3) makes a pretty addition to our English plant-names. Writing of Battersea Park, it speaks of the "formal garden is half-surrounded by five varieties of poplar—the shapeliest, the *arbelia*—whose buds and catkins are a week or more in advance of all such trees in the country round London."

The following, from the *Times* of June 1, is not only an interesting addition to the popular flora of the tombs of the Egyptians but an indication that the New World, whence the plant (*Ipomœa purpurea*) comes, must have been known to that people at a date long before Europe was acquainted with its discovery:—"A morning glory seed, reputed to be 5000 years old, has been brought to Baltimore and planted in the garden of Mrs. W. Champlin Robinson, in Green Spring Valley. The seed is one of 12 found in the hand of a mummy of a young Egyptian girl, which was recently removed to the United States. Ten of the seeds have already been planted, and all of them germinated.—*Reuter*."

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE JOURNAL OF BOTANY was established in 1863 by Seemann. In 1872 the editorship was assumed by Dr. Henry Trimen, who, assisted during part of the time by Mr. J. G. Baker and Mr. Spencer Moore, carried it on until the end of 1879, when he left England for Ceylon. Since then it has been in the hands of the present Editor.

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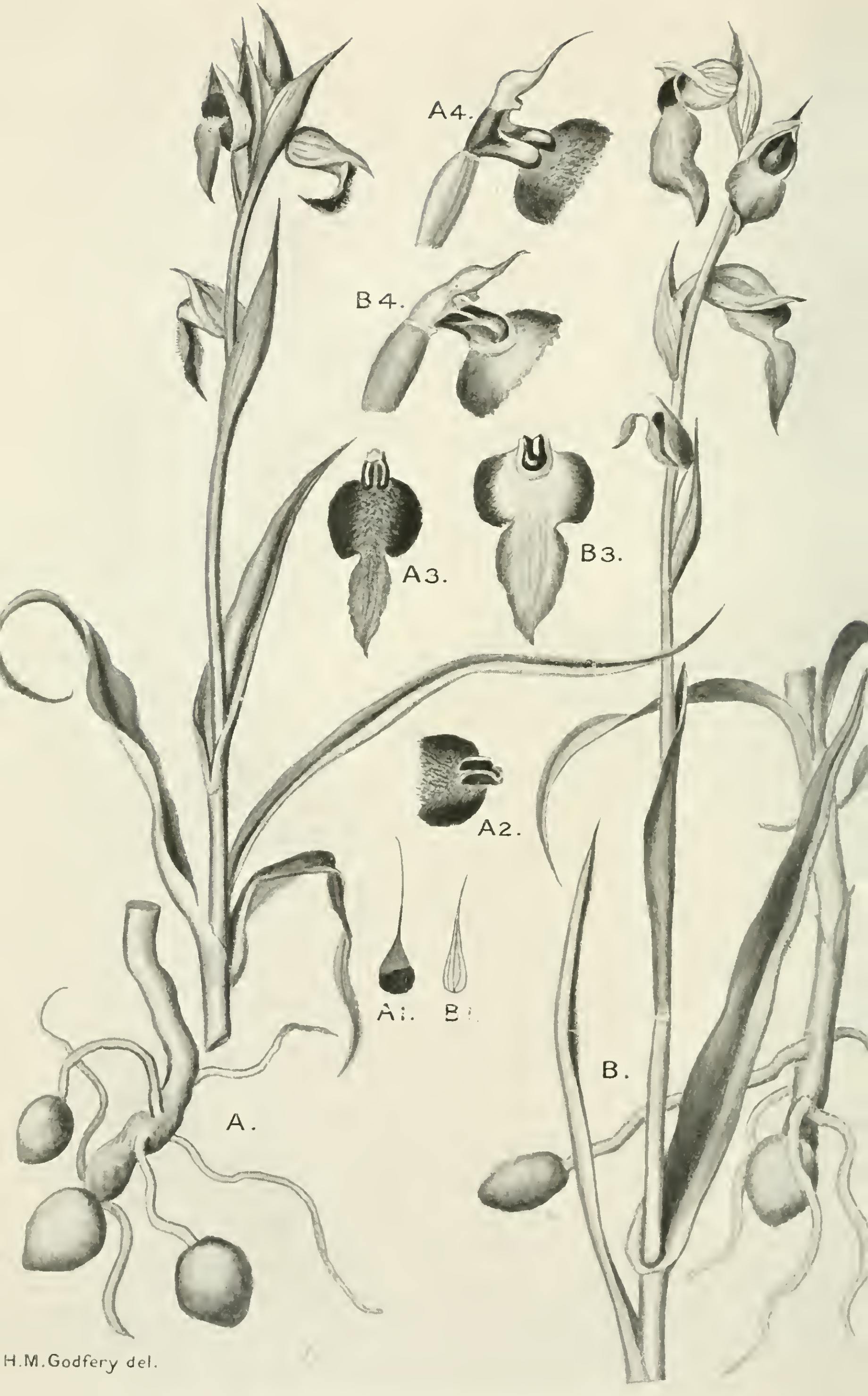
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H.M.Godfery del.

A NEW EUROPEAN SERAPIAS.

By Colonel M. J. Godfery, F.L.S.

(Plate 560.)

Serapias gregaria Godf., sp. nov. *Tubera* tria, globosa, quorum unum sessile duo longipedunculata. *Caulis* sursum ruber, 2 raro 3 dm. alt. *Folia* linearia, acuminata conduplicata, recurva, summa lanceolata, amplexicaulia, erecta. *Spica* laxa, sæpissime 2-flora, floribus quam ii *S. linguæ* paullulum minoribus. *Bracteæ* ovato-lanceolatæ, acuminatissimæ, galeæ sepalinæ culmen vix attingentes. *Sepala* connata nonnunquam apice libera, lateralia anguste lanceolata, acuminata, 3–5-nervia, superius ovato-lanceolatum, acuminatum, ±9-nerve. *Petala* late ovata, subito longe angustissimeque acuminata, basi 3-nervia, margine crispa, atro-rubra, ±17 mm. longa. *Labellum* 3-lobum, sepala longitudine 6–9 mm. excedens, lobis lateralibus rotundatis convolutis galeâ absconditis, lobo intermedio lanceolato acuminato dependente sæpissimæ reflexo pilis erectis rubescentibus dense vestito. *Columna* in toto ±10 mm. longa. *Stigma* oblongum. *Rostellum* rubescens. *Pollinia* dilute viridia; caudiculæ cylindraceæ, flavæ.

Hab. in collibus schistosis ad Hyères.

Tubers 3, one sessile, two long-stalked, globose. *Stem* 2, rarely 3 dm. tall, red above, leaf-sheaths at base often spotted with red. *Leaves* linear, tapering to a fine point, folded, recurved, uppermost broader at base, lanceolate, erect, amplexicaul. Spike lax, flowers slightly smaller than in *lingua*, usually 2, sometimes 3–4, rarely 5, always dark-coloured. *Bracts* ovate-lanceolate, very acuminate, scarcely reaching tip of helmet, pale red, with darker nerves. *Sepals* soldered throughout, rarely free at tip, ashen-grey suffused purple-red, blackish red within, lateral narrow lanceolate acuminate, 3–5-nerved, upper usually broader, concave at base, ovate lanceolate acuminate, ±9-nerved. *Petals* broadly ovate, 3-nerved at base, blackish red, edges crisped, ±17 mm. long, passing abruptly into a long hair-like 1-nerved acumen. *Labellum* 3-lobed, exceeding sepals by 6–9 mm., concolorous, dark liver-red, scarcely paler in the middle, with dense erect reddish hairs extending down the mid-lobe, and with 2 glossy dark red parallel sharp-edged calli at the base; side-lobes rounded, rolled into a tube entirely covered by the helmet; mid-lobe lanceolate, acuminate, dependent, very often reflexed. *Column* blackish purple, ±10 mm. long, including green anther and red beak (4 mm.). *Stigma* oblong on concave face of column; stigmatic fold grooved. *Rostellum* reddish, viscid disc hyaline. *Pollinia* pale green, caudicles cylindrical, yellow.

Hab. Schistose hills, Hyères, absent from limestone. April–May.

On April 7th, 1920, on the dry schistose hills behind Hyères, France, I found a colony of what has always been taken to be *Serapias lingua* L., but on comparison with the descriptions of Rouy and Camus, I noticed the following discrepancies:—(1) The leaf-sheaths at the base of the stem were spotted or streaked with red. (2) The mid-lobe of the lip was often so much reflexed as to be parallel with the under surface of the flower. (3) The base of the lip and the centre of the mid-lobe were densely covered with erect red hairs. (4) The whole lip was concolorous—a dark livid red, not yellowish in the middle, and, more important than all the above, (5) There were 2 parallel calli at the base of the lip, not one single callus as in *lingua*. As 1, 2, and 5 are characters of *S. parviflora* Parl. (*occultata* Gay), I at first thought the plants must be hybrids between it and *S. lingua*. Later on the same plant sprang up in thousands, nearly always in colonies. It was no longer possible to regard it as a hybrid, not only on account of its great abundance and uniformity, but also because not a single specimen of either *lingua* or *parviflora* could be found in the locality. It is true that both these species existed in very limited numbers in moist sandy ground near the sea, but their stations were separated from those of *gregaria* by a wide plain several kilometres across, and moreover *gregaria* did not occur in their neighbourhood.

On April 30th I took examples of the Hyères plant, now rapidly going out of flower, to Vence, where on May 4th I found true *lingua* in early flower. It was easy to see that *gregaria* differed from it even in general appearance. The lip in *lingua* was always attractively coloured, bright rose, yellow, or dark vinous red, usually yellow between the side-lobes, and directed forwards and downwards, never reflexed backwards. The flower was more open, the side-lobes protruding from the helmet, and the callus easily visible. In *gregaria* the lip was always dark red, often so reflexed as to be hidden beneath the flower, and the callus could not be seen without pulling the flower to pieces.

I was therefore forced to the unexpected conclusion that there existed in France a hitherto-unrecorded species of *Serapias*, and decided to name it *Serapias gregaria*, from its habit of growing in colonies. This is due to the annual production of a third tuber, so that the plant is succeeded, accidents apart, by two new plants instead of by one only, as in the majority of orchids, resulting in a rapid vegetative increase. *Lingua* occasionally has 3 bulbs, in *gregaria* it is the rule. It should be noted that *gregaria* flourishes upon the schist, in company with *Orchis Champagneuxii* and *O. saccata*, which are not found off that formation, whilst, at any rate at Hyères, *lingua* and *parviflora* occur, though only sparingly, on moist sandy ground near the sea, where *Barlia longibracteata*, *Ophrys apifera*, and *O. arachnitiformis* are rather abundant, all which plants are absent from the schist, though frequent enough on the limestone. It is difficult to believe that *lingua* and *parviflora* could have given rise to a hybrid which finds its home on an entirely different geological formation.

Plate 560, representing (A) *S. gregaria* and (B) *S. lingua*, shows the differences between them better than a verbal description. The following points should be noted in respect of A:—(1) The red upper stem. (2) The linear leaves tapering to a very fine point. (3) The longer, more acuminate, and darker bracts. (4) The smaller, less open flowers, never brightly coloured as in *lingua*. Though colour is of little value as a specific character, the *uniformity* of the sombre flowers of *gregaria* is in marked contrast with the wide range of colours in *lingua*. (5) The dark petals, almost orbicular at base, passing abruptly into the long acumen, not tapering gradually as in (B). (6) The different shape, size, and colouring of the lip. (7) The marked *structural* difference of the base of the lip, with its two parallel calli.

The following characters of *lingua*, taken from Grenier et Godron, Fl. France (G. G.); Rouy, Fl. France (R.); and Camus, Mon. Orch. Europe (C.) will facilitate comparison. The main points of difference from *S. gregaria* are in italics:—

Tubers 2. Stem 1–4 dm. *not spotted at base* (R.), pale *green* (C.). Leaves *lanceolate*, acute (R.). Flowers 2–6 in a lengthened spike (C.). Bracts *lanceolate* acute, almost half as short as flowers (G. & G.). Sepals *oval lanceolate*, pale violet (C.). Petals *lanceolate, insensibly tapering into an acumen*, with 5 strong nerves at the base (G. & G.), *pale violet* (C.). Lip about *twice as long* as helmet, directed *forwards*, with *one single* blackish callus at the base (R.), pale violet, reddish, sometimes rose or yellow, *always paler* in the middle (C.), usually *glabrous*, or offering a few rare slender hairs (R.); mid-lobe *broadly oval* acute, *glabrous* or very finely pubescent (G. & G.).

S. gregaria is abundant in the Maurettes, a low range of schistose hills at the back of Hyères. I carefully considered the possibility of its being a hybrid. The only other species of *Serapias* growing there are *cordigera* and *longipetala*, but, as both of these have large flowers, a cross between them could hardly produce *gregaria*, which has the smallest flowers of any *Serapias* except *parviflora*, and is not in any way intermediate between the two. I at first thought it might be *lingua* × *parviflora*, but not a single specimen of either of these two species could be found in the Maurettes. How far *gregaria* extends into the geologically similar Maure mountains, I cannot say, my only visit having been to Bormes, when I found *lingua* but not *gregaria*. In 1908 I stayed at Bormes, and was much puzzled by a two-flowered *Serapias*, which I could not reconcile with the descriptions of *lingua*, and now believe to have been *gregaria*.

Before the war the late Mr. F. Raine, of Hyères, a most accurate field-botanist, showed me, on the isthmus of Giens, *Serapias occultata* var. *anomala* Albert. On my remarking that it looked more like *lingua* than *occultata*, he said that in his opinion it had nothing to do with the latter. In April 1920 I found it, much reduced in numbers, in the same station. It agreed admirably with Rouy's description of *S. lingua* (except as stated below), but I could find no character in which it was nearer to *parviflora* than to *lingua*. In April 1921 I compared it carefully with living specimens of *lingua* from Bormes, when it became evident that they were conspecific. The plant should be re-named as follows:—

SERAPIAS LINGUA var. ANOMALA (n. comb.). Tubers 3. Stem 10–15 dm. Flowers smaller. Lip smaller, side-lobes more rhomboid, mid-lobe shorter, callus with yellow base and a shining blackish-red ridge on each side of furrow.

I suggest that the error arose because it was recognised that *anomala* was specifically distinct from *gregaria* (which was accepted without question as *lingua*), and, as it manifestly could not be a form of *cordigera* or *longipetala*, it was natural to consider it a variety of *occultata*, the only other *Serapias* in the locality. This opinion was no doubt confirmed by the fact that *anomala* appears to have two parallel calli, which is the case in *occultata*. This, however, is not really the case. The callus in *anomala* is of the same shape as in *lingua*, but the colouring is different. In *lingua* the whole callus is blackish red and glossy; in *anomala* its main bulk is yellow, of the same colour as the base of the lip, from which the eye does not easily distinguish it, and only the ridges on each side of the furrow are dark red and glossy, giving the impression, by an optical illusion, of two separate calli. The calli of *parviflora* are quite different in shape.

Explanation of Plate 560.

A. *Serapias gregaria* Godf.

B. *S. lingua* L.

1. Petal. 2. Calli, side-view. 3. Lip flattened out. 4. Column with anther, base of lip, and calli (enlarged).

ALABASTRA DIVERSA.—Part XXXIV.

By Spencer Le M. Moore, B.Sc., F.L.S.

(Continued from p. 232.)

2. Phanerocalyx, *Olacacearum* genus novum.

Calyx ultra medium 5-lobus. *Petala* 5, hypogyna calyce paullo longiora, æstivatione valvata, intus barbata. *Stamina* 10, 5 brevia, petalis juxta medium affixa, 5 longiora cum petalis alternantia, sub disco inserta; antheræ biloculares loculis longitrorsum dehiscentibus. *Discus* conspicuus ovarium arcte amplectens, dorso sulcatus. *Ovarium* in fundo disci liberum, late ovoideum, in stylum brevem crassiusculum stigmate simplici coronatum exiens, 3-loculare apice ipso 1-loculare. *Ovula* 3, ab apice placentæ gracilis pendentia. Arbuscula. Folia alterna, petiolata, integra, coriacea, penninervia. Flores parvuli, pedicellati, in fasciculos axillares paucifloros e receptaculis pulvinatis squamellis exiguis onustis oriundos ordinati. Species duæ quæ sunt—

1. **Phanerocalyx Batesii.** Planta omnino glabra; *ramulis* subteretibus cortice fusco aliquantulum nitido circumdatis; *foliis* oblongo-lanceolatis acuminatis apice ipso obtusis basi obtusis utrinque nitidis costis pluribus pag. inf. inconspicuis; *pedicellis* calyce longioribus; *calycis* lobis triangularibus acutis; *petalis* ovato-oblongis obtusiusculis intus superne barbatis; *filamentis* staminum epipetalinorum quam antheræ late ovideæ brevioribus staminum alternipetalinorum superne attenuatis; *ovario* stylo æquilongo.

Yaunde, Bitye, forest by the Ndii Neôlô; *Bates*, 1667.

Folia plerque 7–10 × 3–4 cm., in sicco griseo-olivacea; costa supra impressa subtus eminens; petiolus fac. sup. canaliculatus, 1 cm. long

Pedicelli 2–3 mm. long. Calyx vix 1·5 mm. long.; hujus lobi 1 mm. long. Petala 2 mm., filamenta longiora 1·3 mm., breviora ·3 mm. long. Ovarium cum disco 1·5 mm. diam. Discus ·6 mm. alt. Stylus ·6 mm. long.

2. **Phanerocalyx Talbotiorum.** Planta quoad ramulos foliaque leviter scabriuscula; *ramulis* subteretibus cortice cinereo obductis; *foliis* lanceolato- vel oblongo-obovatis apice acuminatis ipso obtusis nitidulis costis pag. inf. quam eæ pag. sup. magis perspicuis; *pedicellis* calyci æquilongis; *calycis* lobis triangularibus acutis; *petalis* oblongo-lanceolatis acutis medio barbatis; *filamentis* staminum longiorum deorsum expansis apicem versus angustatis; *ovario* stylo longiore.

South Nigeria, Oban; *Talbot*, 450.

Folia 13–14 × 5·5–6 cm., in sicco brunneo-viridia; petioli supra anguste canaliculati, 4–6 mm. long. Pedicelli 1·5 mm. long. Calyx 1·5 mm., petala 2·75 mm. long. Filamenta longiora 1·75 mm., breviora ·5 mm. long. Discus ·5 mm. alt. Ovarium 1 mm., stylus ·5 mm. long.

In its petals and andrœcium this genus is reminiscent of *Ptychopetalum*; but the well-developed calyx, the prominent disk and the three ovules hanging from the top of a slender placenta are important differences. The alternipetalous whorl of stamens undoubtedly keeps it out of *Strombosia*, with which otherwise it might perhaps be merged.

Coula utilis. In Journ. Bot. 1920 (p. 226) this was described as a supposed new (and second) species, and this is a fitting place to remark that Dr. de Wildeman has been good enough to call my attention to his description of *Coula Cabræ* in Bul. Soc. Bot. Belg. xxxviii. 189, unfortunately overlooked by me. On comparing this description with that of *C. utilis* some discrepancies come to light; the chief one concerns the leaves, which are said to be coriaceous like those of *C. edulis* Baill. In spite of this there are some points of agreement tending to suggest that the two may be conspecific, although this cannot be decided satisfactorily in the absence of material for comparison.

3. Specierum novarum Occidentali-Australiensium pugillus.

Mr. Oswald Sargent of York (W.A.) has for some years been known as a careful student of the West Australian Flora. In this connection readers of this Journal will remember his paper on climbing Droseras (vol. li. pp. 38 *sqq.*). A small parcel recently sent by him to the Museum has yielded the presumed new species which, at his own request, are here described.

Thomasia hexandra, sp. nov. Verisimiliter *suffrutex*, *ramulis* gracilibus minute griseo-tomentosis dein glabrescentibus; *foliis* subsessilibus linearibus vel lineari-oblongis utrinque obtusis margine arcte revolutis transverse rugatis coriaceis pag. utraque minute griseo- vel brunneo-tomentosis; *stipulis* parvis semihastatis obtusis; *racemis* folia certe excedentibus gracilibus paucifloris pubescentibus; *bracteis* filiformibus quam pedicelli longioribus uti pedicelli bracteolæque brunneo-glandulose tomentosis; *bracteolis* ovato-oblongis obtusis

sepalis brevioribus; *sepalis* 6 (casu 5) fere usque basin solutis oblongis vel ovato-oblongis obtusis; *petalis* (uti staminodia) 0; *staminibus* 6 antheris inter se liberis poro apicali dehiscentibus; *ovario* subgloboso tomentoso 3-loculari; *ovulis* quove in loculo perpaucis; *stylo* glabro.

Emu Hill (about 50 miles east of Beverley), by State School; Hb. Sargent, 782.

Folia pleraque 1·5–2·5 cm. long. (exstant minora ± 1 cm.), ob margines valde revolutos modo 2–3 mm. lat., marginibus vero explicatis 3·5 mm. Stipulæ in toto 2·5–4 mm. long. Racemi 4–5-flori, circa 4·5 cm. long. Bracteæ circa 3 mm., bracteolæ 5–6 mm. long. Sepala 7 mm. long., nunc 3 mm. nunc modo 1·5 mm. lat. Antheræ oblongæ, obtusæ, saturate purpureæ, 2 mm. long. Ovarium 1·5 mm. diam. Stylus tener, 1·5 mm. long.

Affinity with *T. angustifolia* Steud. The hexandrous flowers with almost free sepals are peculiar features.

Eremophila (§ *Eriocalyx*) **compacta**, sp. nov. *Frutex* compactus, metralis; *ramulis* griseo-tomentosis deinde glabrescentibus basubus persistentibus prominentibus foliorum mortuorum signatis; *foliis* sessilibus lineari-oblongis obtusis basi breviter decurrentibus coriaceis utrobique griseo-tomentosis pag. sup. pustulis sat perspicuis inspersis; *floribus* ex axillis summis perpaucis ortis breviter pedicellatis pedicellis (uti calyx) griseo-tomentosis; *calycis* usque basin divisi segmentis oblongis obtusis coloratis; *corollæ* extus glabræ tubo lato calycem excedente superne amplificato lobis suborbicularibus quam tubus brevioribus; *staminibus* inclusis; *ovario* oblongo glabro; *stylo* exserto glabro.

Yalgoo, on redsoil hills or flats; *Miss Brown.* (Hb. Sargent, 781).

Folia plerumque 10–15 × 3–4 mm., pag. inf. costa media prominente percursa. Pedicelli 2–3 mm. long. *Calycis* segmenta 10–12 mm. long. Corolla dilute punicea, in toto circa 2 cm. long.; tubus 13 mm. long., basi 5 mm., superne 10 mm. lat.; lobi ±8 × 7 mm. Ovarium 3 mm., stylus 19 mm. long. Ovula in loculis 2, superposita.

Close to *E. Bowmanni* F. Muell., of which it would seem to be the western representative. The short pedicels and the larger and broader coloured segments of the calyx are characteristic points seen at a glance.

Pholidia Sargentii, sp. nov. *Frutex* habitu ericoideo; *ramulis* sat gracilibus crebro foliosis uti folia succum resinosum exsudantibus; *foliis* parvulis approximatis sessilibus alternis linearibus obtusis apice sæpe breviter recurvis optime decurrentibus coriaceis in sicco viridibus; *floribus* in axillis solitariis pedicellis folia plane excedentibus fultis; *calycis* segmentis basi brevissime connatis ovatis apice mucronulatis breviterque recurvis; *corolla* ex calyce longe eminente extus glabra tubo paullulum supra basin usque ad limbum dilatato lobis oblongo-ovatis obtusis lobo intermedio latiori necnon obcordato; *staminibus* didynamis inclusis; *ovario* oblongo stylo subincluso coronato.

Wongan Hills; 793.

Folia 3–4 × 1 mm.; bases decurrentes valde prominentes, 2–3 mm. long. Pedicelli filiformes, ipso sub flore dilatati, solemniter 5–6 mm. long. Calycis segmenta 3 mm. long. Corolla cyanea, humectata in toto 11 mm. long.; tubus 7 mm. long., basi 2 mm. superne 5 mm. lat.; lobi 4 mm. long., 2·5–3 mm. lat., lobus intermedius 5 mm. lat. Ovarium glabrum, vix 2 mm., stylus glaber, 8·5 mm. long. Ovula collateralia.

Near *P. elachantha* Diels, but with smaller leaves, broader not ciliate calyx segments, longer corolla, etc.

Lachnostachys cordifolia, sp. nov. *Frutex* arcte griseo- (vel fulvo-) lanato-tomentosus; *ramulis* validis crebro foliosis; *foliis* sessilibus cordatis obtusis margine revolutis coriaceis; *spicis* pluribus ramulos terminantibus folia excedentibus cylindricis dense plurifloris lana arcta dilute fulva involutis; *pedicellis* calyce multo brevioribus; *calycis* subglobosi circiter usque medium divisi segmentis 7 triangularibus acutis dorso longe lanatis; *corolla* parvula ore truncata; *staminibus* 7 corollæ ori insertis longiuscule exsertis; *ovario* subgloboso glabro in stylum longiorem crassiusculum glabrum exeunte.

"Sand Springs," about 15 miles S.E. of York; *Geo. Turvey* (Hb. Sargent, 808).

Folia 1·5–2 × 1–1·2 cm. Spicæ profecto evolutæ 3–4 × 1·2 cm. Pedicelli 1 mm. long. Calyx (lana haud exempta) 5 × 4·5 mm. Corolla extus glabra, intus villosa, ægre 2 mm. long. Filamenta usque 2 mm. exserta, glabra. Ovarium ·75 mm., stylus 5 mm. long.

Affinity with *L. brevispica* E. Pritz., from which the cordate leaves at once serve to distinguish it.

Prostanthera (§ *Klanderia*) **arenicola**, sp. nov. *Frutex* intricate ramosus sparsim breviterque hispidulo-pubescens; *ramulis* subteretibus foliosis; *foliis* minutis ovatis vel oblongo-obovatis obtusis vel obtusissimis crassiusculis plus minusve recurvis; *floribus* paucis in axillis solitariis pedicellis quam calyx brevioribus insidentibus; *bracteolis* ad apicem pedicelli exiguis anguste linearibus obtusis; *calycis* ambitu oblongo-obovati tubo fere glabro labiis tubo brevioribus late ovatis inter se paullo inæqualibus; *corolla* calyce duplo longiore extus puberula vel pubescente coccinea tubo leviter incurvo a basi gradatim dilatato labio antico erecto paullulum galeato emarginato quam posticum patulum longiore; *staminibus* leviter exsertis antherarum loculo altero breviter appendiculato; *stylo* exserto.

Gnowangerup, sand plain; 858.

Folia 1·5–2 mm. long., 1–1·5 mm. lat. Pedicelli 2–3 mm. long. Bracteolæ ±2 mm. long., calyci applicatæ. Calycis tubus 5 mm long., basi 2 mm. superne usque 5 mm. gradatim ampliatus; labium majus 4 mm., minus 3 mm. long. Corollæ tubus 12 mm. long., ima basi 1·75 mm.; sub limbo 7 mm. lat.; labium posticum 7 mm., anticum 5 mm. long. Stylus usque 2·5 mm. exsertus.

Near *P. microphylla* A. Cunn. and *P. coccinea* F. Muell., two plants regarded as conspecific by Bentham, but certainly in error. Brown's *Cryphia serpyllifolia*, which Bentham also refers to *P. microphylla*, would seem to be a third species. These three East Australian species will be seen on careful examination to have, *inter alia*, quite different leaves from each other and also from *P. arenicola*,

which is exclusively West Australian, and includes *Drummond*, 341, as well as an unlocalised Maxwell specimen in the British Museum, and most probably the other specimens of Maxwell Bentham mentions (Fl. Austral. v. 107).

While dealing with this genus it may be well to notice a mistake into which Dr. Hochreutiner has fallen. He remarks of *P. marifolia* R. Br. (Bull. N. York Bot. Gard. vi. 285) that Bentham (Fl. Austral. v. 98) says of it "leaves not rugose." This, he continues, "is an obvious error which may lead to false naming. All specimens of this species in the Kew Herbarium, and especially the type, are very rugose." The mistake, however, is not Bentham's, as Brown's "type"—which, by the way, is, of course, in the National Herbarium—shows. Had Dr. Hochreutiner compared the leaves of the type with those of *P. rugosa* A. Cunn., the species Bentham contrasts with *P. marifolia* in his clavis, he would at once have seen the difference between the two, for while those of *P. rugosa* are "very rugose," as Bentham states, those of *P. marifolia* are "scabrous hispid above but not rugose," a description exactly fitting the case. Curiously enough, Brown (Prodr. 509) describes the leaves as "pilose," surely an incorrect term for them!

Westringia discipulorum, sp. nov. *Frutex* nisi *suffrutex*; *ramulis* bene foliosis uti folia pube crispa griseo obtectis; *foliis* 3- vel 4-nis (anne semper?) teretibus linearibus obtusis marginibus arcte revolutis coriaceis ascendentibus; *floribus* in capitulum densum terminalem aggregatis foliis floralibus spathulatis dorso villosulis intermixtis; *calycis* anguste campanulati medium usque divisi segmentis anguste oblongis obtusis margine villosulis; *corollæ* tubo cylindrico utrinque pilosulo labiis tubo paullo brevioribus horum lobis ovato-oblongis obtusissimis, lobo intermedio obovato retuso; *staminibus* exsertis antherarum connectivo breviter producto staminodiis abbreviatis filiformibus apice barbellatis.

Yorkrabine, by State school; 811.

Folia 10–12 mm. long., summa vero paullo breviora, 1 mm. lat. Folia floralia 6–8 mm. long. Calyx totus 4 mm. long. Corollæ tubus 4·5 mm. long., 1·65 mm. lat.; labia 3 mm. long. Filamenta 3 mm., antheræ 1 mm., staminodia 1 mm. long.

The indumentum foliage, etc., mark this as a very distinct species. The plant is called the "White Button Bush," apparently from its densely packed heads of white flowers.

4. A New Triaspis.

The Malpighiaceous genus *Triaspis* comprises 25 species, 20 of which are found in tropical or South Africa, while Madagascar is the home of the rest. As is so frequently the case, recent research has added considerably to the size of the genus, which it is now proposed further to enlarge by including the species here described.

Triaspis Thorncroftii, sp. nov., *ramulis* teretibus bene foliosis brunneis primo sparsim appresse pilosulis cito glabris; *foliis* subsessilibus cordatis acutis basi amplexicaulibus pergamaceis glaucis glabris arcte reticulatis; *racemis* subumbellatis sæpissime 6–8-floris; *pedicellis* elongatis filiformibus glabris ad circa 5 mm. supra basin articulatis; *bracteis* parvulis subulatis; *sepalis* oblongis obtusis glabris; *petalis* ovatis unguiculatis quorum 3 margine fimbriatis; *filamentis* filiformibus stylis circa æquilongis; *ovario* villoso 3-lobo lobis ambitu ovatis; *stylis* 3 crassiusculis sursum incurvis; *samaris* 3 late ovalibus apice rotundatissimis nonnunquam retusis glabris.

Barberton, alt. 2000 ped.; *Thorncroft sine no.*

Folia pleraque ±4 cm. long., 2–2·5 cm. lat., summa gradatim imminuta; petioli 1 mm. long. Racemi florentes circa 3 cm. long. Pedicelli plerumque 15–20 cm., bracteæ 1 mm. long. Sepala 1·5 mm. long. Petala majora in toto 8 mm. long., 4 mm. lat., horum unguis 2 mm. long. Filamenta 4 mm., styli 4 mm. long. Samaræ 2·5 × 2·5 mm., dilute griseo-viridescentes, optime reticulatæ.

Nearest *T. glaucophylla* Engl., differing chiefly in the almost complete absence of indumentum, in the cordate-acute amplexicaul leaves, the narrower sepals, longer and broader petals, and differently shaped samaras.

THE GENERIC NAME SCHIZONOTUS.

By T. A. Sprague, B.Sc., F.L.S.

The name *Schizonotus* has been used for two genera of *Rosaceæ* and one of *Asclepiadaceæ*. *Schizonotus* Lindl. (1830) is *Sorbaria* A. Br. (1864), a nomen conservandum under the International Rules of Nomenclature. *Schizonotus* Rafin. (1836) is *Holodiscus* Maxim. (1879), which is also a nomen conservandum. *Schizonotus* A. Gray (1876) is equivalent to *Solanoa* Greene (1890), and *Solanoana* Kuntze (1891). As the citations in the *Index Kewensis* of *Schizonotus* Lindl. and *Schizonotus* Rafin. are not as complete as might be desired, the references and synonymy of the three genera are now given in detail.

Sorbaria A. Br. in Aschers. Fl. Brandenb. ed. 1, 301 (1864); Focke in Engl. et Prantl, Nat. Pflanzenf. iii. 3, 16 (1888); Dalle Torre et Harms, Gen. Siphonog. 206 (1901); Schneider, Laubholzk. i. 486 (1905); Rehder in Sarg. Pl. Wils. i. 47 (1911) [*Rosaceæ–Spiræeæ*].

Spiræa sect. *Sorbaria* Ser. in DC. Prodr. ii. 545 (1825).

Spiræa sect. *Schizonotus* Meisn. Gen. i. 103 (1836–43).

Schizonotus Lindl. ex Wall. Cat. n. 703 (1829), in syn.; Lindl. Introd. Nat. Syst. 81 (1830); Bot. Reg. xvi. sub t. 1365 (1830); et l. c. xxvi. Misc. Not. 71 (1840); Rydb. in N. Am. Fl. xxii. 257 (1908); Britton et Brown, Ill. Fl. ed. 2, ii. 247 (1913).

Basilima Rafin. New Fl. iii. 75 (1836); Aschers. Fl. Brandenb. 934 (1864); Kuntze, Rev. Gen. pars 1, 215 (1891).

Holodiscus Maxim. in Act. Hort. Petrop. vi. 253 (1879); Focke in Engl. et Prantl, Nat. Pflanzenf. iii. 3, 18 (1888); Greene, Man. Bot. San Francisco Bay, 113 (1894); A. A. Heller, Cat. N. Am. Pl. ed. 2, 98 (1900); Dalle Torre et Harms, Gen. Siphonog. 206 (1901); Jepson, Fl. W. Mid. Calif. ed. 1, 277 (1901); ed. 2, 204 (1911); Schneider, Laubholzk. i. 495 (1905) [*Rosaceæ–Holodisceæ*].

Schizonotus Rafin. New Fl. iii. 74 (1836); Greene, Fl. Francisc.

58 (1891): Kuntze, Rev. Gen. pars 1, 225 (1891); Rehder in Bailey, Cycl. Am. Hort. 1626 (1902); non Lindl.

Sericotheca Rafin. Sylva Tell. 152 (1838); Rydb. in N. Am. Fl. xxii. 261 (1908).

Spiræa sect. *Holodiscus* K. Koch, Dendrol. i. 309 (1869).

SOLANOA Greene in Pittonia, ii. 67 (1890); et in Man. Bot. San Francisco Bay, 242 (1894); Jepson, Fl. W. Mid. Calif. ed. 1, 384 (1901); ed. 2, 324 (1911) [*Asclepiadaceæ–Asclepiadinæ*].

Schizonotus A. Gray in Proc. Am. Acad. xii. 66 (1876), in adnot.; Syn. Fl. N. Am. ed. 2, ii. 86, 100 (1886); S. Wats. Bot. Calif. ii. 463 (1880); Rattan, Anal. Key W. Coast Bot. 78 (1888); K. Schum. in Engl. et Prantl, Nat. Pflanzenf. iv. 2, 237 (1895); Dalle Torre et Harms, Gen. Siphonog. 413 (1904).

Solanoana Kuntze, Rev. Gen. pars. 2, 421 (1891).

The effective publication of *Schizonotus* Lindl. dates from Lindley's *Introduction to the Natural System of Botany* (1830). The genus was founded on *Spiræa sorbifolia* Linn., and distinguished by the fruit being capsular. The letterpress accompanying Bot. Reg. t. 1365, published in Nov. 1830, contains the following paragraph: "This [*Spiræa ariæfolia*] is one of a set of plants which, if they be considered the type of the genus *Spiræa*, are distinguished by their oligospermous distinct carpella and exstipulate leaves; they are nevertheless retained by the most recent botanists that have examined them, in the same group as *Spiræa Aruncus*, *opulifolia*, and *sorbifolia*,—in all which the habit, fruit, and foliage, are decidedly different. We confess it appears to us, that there is little consistency in this, while such genera as *Sieversia* and *Geum*, *Potentilla* and *Fragaria*, are separated. Surely it would be more conformable to the modern principles of constructing genera, principles that have been well illustrated by M. De Candolle's recent work upon *Umbelliferæ*, to consider the old *Spiræa* made up of several distinct genera; among which Seringe's section *Sorbaria* [based on *S. sorbifolia*], or our *Schizonotus*, which is to *Rosaceæ* nearly what *Nigella* is to *Ranunculaceæ*, should be among the first to be recognised."

Lindley thus explicitly retained *S. ariæfolia* (*S. discolor*) in *Spiræa* and separated *S. sorbifolia* as the type of a new genus, *Schizonotus*, on account of its syncarpous gynæceum. Yet Rafinesque stated six years later that he adopted the genus and name *Schizonotus* for *S. discolor* "on the suggestion of Lindley, who proposed to unite to it the next [*S. sorbifolia*], but the habit is too different." Having transferred the name *Schizonotus* to a different genus, Rafinesque proposed the name *Basilima* for *Schizonotus* Lindl. One can hardly wonder that Rafinesque's work was ignored by his contemporaries, if this is a representative sample.

As both *Schizonotus* Lindl. and *Schizonotus* Rafin. were tacitly included under *Spiræa* Linn. in Bentham and Hooker's *Genera Plantarum*, the fact that they were different genera seems to have escaped notice, and Rafinesque's *Schizonotus* was merged in Lindley's in the *Index Kewensis*. Kuntze pointed out in 1891 that Lindley's *Schizonotus* was synonymous with *Basilima*, and Rafinesque's with *Holodiscus*, but overlooked the fact that Lindley's genus was effectively published in 1830. This fact was pointed out in 1908 by Rydberg, who accepted *Schizonotus* Lindl. (1830) in place of *Basilima* (1836) and adopted *Sericotheca* Rafin. as a prior name for *Holodiscus*. It may be mentioned that Rafinesque himself gave the date of publication of *Basilima* as 1815, but this has not been confirmed.

Before *Schizonotus* Rafin. and *Schizonotus* Lindl. had been revived, Asa Gray applied the name *Schizonotus* to a new genus of *Asclepiadaceæ*, segregated from *Gomphocarpus*. It will be seen from the synonymy given above that *Schizonotus* has been used by Greene, Kuntze, and Rehder (1891–1902) in the sense of *Holodiscus*; by Rydberg and Britton (1908–1913) in place of *Sorbaria*; and by Asa Gray, S. Watson, and Schumann (1876–1895) for an asclepiadaceous genus which was re-named *Solanoa* by Greene in 1890. The name *Schizonotus* has thus become ambiguous and it therefore seems desirable to abandon its use.

According to a strict interpretation of the International Rules, the names *Sorbaria* A. Br., *Holodiscus* Maxim., and *Schizonotus* A. Gray should be adopted for the three genera in question; it can hardly be doubted, however, that the retention of *Schizonotus* A. Gray, would lead to confusion; and Jepson, who followed the International Rules in other respects, accordingly used the name *Solanoa* Greene, in preference. This is in harmony with one of the principles on which the Rules are founded: to reject the use of names which may cause error or ambiguity (Art. 4). According to the American Code, the three genera should bear the names *Schizonotus* Lindl., *Sericotheca* Rafin., and *Solanoa* Greene respectively. The species published under *Schizonotus* may be assigned to *Sorbaria*, *Holodiscus*, and *Solanoa* as follows:

Schizonotus Aitchisoni Skeels in U.S. Dept. Agric. Bur. Pl. Ind., Bull. 242, 38, n. 30758 (1912)=SORBARIA AITCHISONI Hemsl.

Schizonotus argenteus Kuntze, Rev. Gen. pars 1, 225 (1891)= HOLODISCUS ARGENTEUS Maxim.

Schizonotus ariæfolius Greene, Fl. Francisc. 58 (1891)=HOLODISCUS DISCOLOR Maxim.

Schizonotus discolor Rafin. New Fl. iii. 75 (1836)=HOLODISCUS DISCOLOR Maxim.

Schizonotus dumosus Koehne, Deutsche Dendrol. 265 (1893)= HOLODISCUS DUMOSUS A. A. Heller.

Schizonotus Lindleyanus Wall. ex Steud. Nomencl. ed. 2, ii. 531 (1841)=SORBARIA LINDLEYANA Maxim.

Schizonotus purpurascens A. Gray in Proc. Am. Acad. xii. 66 (1876)=SOLANOA PURPURASCENS Greene.

Schizonotus sorbifolius Lindl. ex Steud. Nomencl. ed. 2, ii. 531 (1841)=SORBARIA SORBIFOLIA A. Br.

Schizonotus tomentosus Lindl. Bot. Reg. xxvi. Misc. Not. 71 (1840)=SORBARIA LINDLEYANA Maxim.

ARCYRIA VIRESCENS, SP. N.

By G. Lister, F.L.S.

Among the specimens of Malayan Mycetozoa obtained by Mr. I. H. Burkill, F.L.S., Director of the Botanic Gardens, Singapore, is a handsome species of *Arcyria* with yellowish-green spores. It had developed on a block of wood in orchid pits in the Gardens in February 1916, and was courteously sent to me for identification. The striking features are the green spores, the long slender stalks, and the loose columns of buff or khaki-coloured capillitium, the threads of which are marked with scattered groups of prominent transverse ridges. I wrote to Mr. Burkill suggesting that he had met with a new species, and expressing the hope that more of it might be found.

The integrity of the species has been well established by the observations of Mr. A. R. Sanderson, F.L.S., who collected it at Naboda, Ceylon, in August 1918, and during his residence in the southern part of the Malay Peninsula from 1919 to 1921 he found it was not uncommon in the neighbourhood of Johore.

There is also a gathering of the same species in the Kew Herbarium from North Queensland (No. 155) collected by Pentzke near the Daintree River over forty years ago. (I am indebted to Miss E. M. Wakefield for deciphering "Daintree River," and for explaining the collector's name, which is written "Pentzoke" on the mounting sheet by mistake.) It is in poor condition and consists of a tangle of apparently weathered olive-brown capillitium, without stalks and with few spores; the rather stout threads show the characteristic groups of prominent transverse ridges which, apart from the other features, distinguish the new species from *Arcyria nutans* Grev. and *A. Oerstedtii* Rost. The specimen is marked "*Hemiarcyria fuliginea*," but is clearly different from the type specimen of *H. fuliginea* Cooke and Massee from New South Wales, laid out on the same sheet, which is a faded form of *Arcyria Oerstedtii*.

The following is a detailed description of the new green-spored species, for which I propose the name *Arcyria virescens*.

Arcyrea virescens, sp. n. Plasmodium? Sporangia stalked, cylindrical. Stalks slender, straight or flexuose, dark olive-green, 0·5 to 1·5 mm. long, arising from a membranous hypothallus, loosely grouped or united in clusters of three to ten, and widening upwards into narrow funnel-shaped sporangial cups; walls of the cup membranous, reticulated and spinose on the inner side. Capillitium a loose elastic network of dull ochraceous or khaki-coloured threads, unattached to the cup and expanding into a column about 6 mm. long; capillitium threads 4 to 6μ diam., marked with scattered groups of close-set prominent transverse ridges, 3 to 5μ deep, arranged more or less in a loose spiral; the remaining surface irregularly reticulated and roughened with delicate often broad-based spines. Spores yellowish-green in mass, 7 to 8μ diam., smooth except for a few scattered warts.

Habitat on dead wood; Ceylon, Malay Peninsula, Queensland.

A. virescens differs from *A. glauca* Lister, the only other species of *Arcyria* with green spores, in the long dark stalks, narrow cups, and stouter capillitium marked with groups of prominent bars, as well as in the yellower shade of both capillitium and spores.

The elasticity of the capillitium and the ease with which the loose columns separate from the sporangial cups causes rapid dispersion of the spores, and perfect specimens showing the colour of the spores in mass appear to be seldom found. This probably accounts for the species having been overlooked, and regarded as a faded form of *A. nutans.* I have certainly made this mistake myself more than once in the past.

THE FLOWERS OF TRAGOPOGON:

THEIR TIMES OF OPENING AND SHUTTING.

By Miller Christy, F.L.S.

Everyone is familiar with the fact that the flowers of the Yellow Goats's-beard (*Tragopogon pratense*) open early in the morning and close about mid-day, a habit which has gained for the plant the popular name of "Jack Go-to-bed-at-Noon."

This habit has long been known. Over three centuries ago, Gerard (*Herball,* 595; 1597) wrote that "It shutteth itselfe at twelve of the clocke, and sheweth not his face open untill the next daies sunne do make it flower anew." Linnæus, too, knew of and made definite observations upon the habit. In his *Horologium Floræ,* or 'Floral Clock,' he notes (Phil. Bot. 273–5; 1751) that, at Upsala (lat. 59° 51′ N., long. 17° 37′ E.), the flowers of *Tragopogon luteum* (=*T. pratense*) open each morning between 3 and 5 A.M. and close for the day between 8 and 10 A.M., their open hours being earlier than those of any other of the forty-six species of flower on which he had made observations. Since his time, Kerner has made similar observations at Innsbruck (lat. 47° 16′ N., long. 11° 24′ E.) (see his Nat. Hist. of Plants, ii. 215–221; 1902), but unfortunately his list does not include the particular species in question. He notes, however that two nearly-allied species, *T. floccosus and T. orientalis,* both open there between 6 and 7 A.M. and close between 10 and 11 A.M.

Yet, apart from this, I have been unable to find that anyone has taken the trouble to observe and to record more precisely the plant's exact hours of opening and closing its flowers. In these circumstances, it may be worth while to place on record a few desultory observations which I have made from time to time on the open-hours of the flowers of both this plant and its near ally the Salsify (*T. porrifolius*).

Some of my notes on the subject are of little or no value, as they record no more than the fact that I observed the flowers either open or closed (as the case might be) at some time during its well-known open-hours or the reverse. Yet two such deserve noting, in view of what follows:—On 6th June, 1881, at Roxwell, Essex, I saw several plants with their flowers fully open at about 12 noon, the weather at the time being very dull and overcast. Again, as showing how completely the flowers close, I find a note that, at about 5 P.M. on 6th June, 1882, a dull rainy day, I was scarcely able to find certain plants growing among long grass in a meadow near the same place, though I had seen them fully open and very obvious on the morning of the previous day, which, though fine, had been dull and cool.

In July 1882, when spending the summer at St. Moritz, in the Ober-Engadine (lat. 46° 30′ N., long. 9° 50′ E.), I had a good opportunity of making systematic observations; for I found several plants, growing among the grass on the mountain-side, within a few feet of the door of my hotel, which had a southerly aspect. At the date indicated, the flowers of this species would have been over, of course, for some weeks in England, where the usual flowering time of the plant is late in May and early in June; but in the Engadine, at an elevation of about 6000 feet, they were still out fully.

Broadly speaking, my observations (which have been confirmed casually on later occasions elsewhere) went to show that, in favourable weather conditions, the flowers always opened before 8 A.M. and closed again before 12 noon. I confess I was never about early enough in the morning to see the flowers in question before they opened; but I believe they did so as a rule shortly before 8. On the 19th July, a very exceptionally hot bright day, I noted specially that the flowers were already open before 8, and that they had closed again almost completely before 12 noon. On the following day, the 20th, which was similiar in regard to weather, the flowers opened about the same time, but had closed soon after 9. I was puzzled by this very early closing, for which, at the time, I could see no reason. Perhaps, however, the plant had some sort of intuitive forewarning (so to speak) that the weather was about to change; for it did so completely on the following day, the 21st, which was cold, dull, and windy, with rain in the evening. On this day, the flowers which I found were open at 8.30 had closed almost completely by 9.15, and did not open again during the day. Yet, on the next day, the 22nd (which, though warm, was overcast, with slight rain), the flowers reverted, for some inscrutable reason, to their normal hours and remained open till nearly 12. On the two following days, the 23rd and 24th, which were both dull, cool, and rainy, the flowers again remained open until nearly 12. There was nothing, so far as I could see, to explain this change, unless, perhaps, it was to afford the flowers the greatest possible chance of securing pollination before they went off altogether. At any rate, at this time, most other flowers of the species were already over and consequently my chance to make further observations came to an end.

The foregoing observations on *T. pratense* seem to show, so far as they go:—

(1) That, at Upsala, the open hours of its flowers occur some three or three-and-a-half hours earlier than they do in the valley of the Inn, some 13 degrees farther south and some six degrees farther west, where the observations of both Kerner and myself were made.

(2) That, while its flowers have their normal open-hours, their hours of both opening and closing are liable to be varied considerably (especially, it seems, those of closing) by the prevailing weather

conditions. This fact, not very generally recognized, was noted by Lubbock nearly fifty years ago (*British Wild Flowers in relation to Insects*, p. 22, *n.*; 1875).

(3) That, roughly speaking, its flowers remain open for no more than about four hours out of the twenty-four. I observed also—

(4) That its flowers are not ephemeral: that is to say, each individual flower opens on more than one day; but on how many days in succession it does this I failed to ascertain.

Later, I made similar observations, as stated already, on the closely-allied *Tragopogon porrifolius*—a plant I have been accustomed to grow in my garden for culinary purposes. As a rule, the plant when grown with that object is not allowed to flower, being dug up to make room for some new crop as soon as its roots are ready for the pot. Consequently, few people are aware how fine a sight a bed of Salsify in full flower may present, during the following summer, if surplus roots, instead of being dug up and thrown away, are allowed to remain in the ground and produce blossoms. In that case, its handsome purple flowers will present, early in the following June, a gorgeous mass of colour which will astonish those who know the plant merely as a pot-herb or as a casual escape from cultivation. Further, after its flowers have gone off, its seeds (each of which is provided with a "parachute," exactly like that of *T. pratense*) will attract crowds of small birds (especially, in my case, Goldfinches) which devour them greedily.

The flowers of *T. porrifolius* resemble in all respects except colour those of *T. pratense.* In respect of opening and closing, they behave in exactly similar ways, except that they appear both to open and close slightly earlier in the day. Thus I observed many times that they opened, as a rule, soon after 7 A.M. and closed well before noon. Their open-hours were, however, dependent to some extent on the prevailing weather conditions, as in the case of *T. pratense.* Thus on 10th June, 1916, when I had two separate beds in full bloom, most of the flowers did not open at all and the rest to a small extent only, the day being stormy, dark, and overcast.

The autonomous openings and closings of flowers in those species in which the open-hours are limited to a few special hours during the twenty-four (the particular hours varying according to the species) have never been, I think, adequately studied.

One's first thought is, naturally, that the open hours of any particular species of flower will be found to synchronize with the hours of flight of the particular species of insects which habitually pollinate it, just as some flowers which are regularly pollinated by night-flying moths remain closed during the day and open only in the evening. This theory is plausible enough in itself; but in the case of *Tragopogon* it seems entirely inapplicable; for the insects by which it is usually visited (namely, Diptera, Hymenoptera, and Lepidoptera: see Knuth, *Pollination of Plants*, ii. 679; 1908) remain habitually upon the wing throughout the whole of the day.

Another very plausible theory is that plants which are normally pollinated by large day-flying insects may, by opening and closing early in the morning only, escape the depredations of small, creeping, pollen-eating, and nectar-stealing insects, especially ants, which cannot travel until the dew is off the herbage. This applies no doubt to some species of plants; but it seems not to apply to the case of the *Tragopogon*, which in our latitude remains open usually till about noon, by which time as a rule the dew has long been off the herbage.

A much more likely theory is that the open-hours of all these short period flowering plants is governed, in some way, by the access of the sun's light and heat. Experiments made by Kerner (see his Nat. Hist. of Plants, ii. 219–221; 1908) have shown, indeed, that this is really the main governing cause of the phenomena presented by the flowers of these plants. At all events, it appears to explain adequately why the open-hours of the flowers of the Tragopogons should be from three to three-and-a-half hours earlier at Upsala than in the valley of the Inn, some thirteen degrees farther south, and six degrees farther west; for the sun rises earlier in the more northerly locality than in the more southerly.

Yet this theory by no means explains all the problems involved. That some flowers should thus "go to sleep" (as village children express it) for a certain portion of each day whilst others keep "awake" (so to speak) the whole day is comparatively easy of explanation; for flowers attain their chief object (namely, their pollination) by many different means—some by one, some by another.

A problem much more difficult of solution is that involved in the question why different species of these "sleeping" flowers should differ so remarkably in their waking or open-hours, when all are exposed, in the same degree, to the light and heat of the sun. Lubbock raised this question nearly half-a-century ago (*Flowers in relation to Insects*, p. 21; 1875), but he failed to answer it; and, so far as I am aware, no one has answered it satisfactorily since his time.

It may be urged, with a high degree of probability, that the opening and closing of most flowers is governed, in some way or other, by the *angle* at which the sun's rays strike the flower. In the case of these "sleeping" flowers, it will be found that most, if not all, open directly upwards, thus rendering them specially liable to be acted upon in this way.

But these theories, even if accepted fully, do not solve—on the contrary, they raise—the problem:—How is it that some flowers which "sleep" do so at one period of the day whilst others do so at another time of day, though all alike must receive the rays of the sun at the same angle and in the same degree?

One can only suggest, by way of solution, that the petals of these sleeping plants may be provided with some mechanism, more or less analogous to the "eye" of the fungus *Pilobolus*, lately described by Prof. Reginald Buller (see Trans. Brit. Mycol. Soc. vii. 61; Journ. Bot. 1921, 206), which causes each of these flowers to open or close (as the case may be) when the sun's rays happen to fall upon it at some particular angle.

P.S.—Since the foregoing was put into type, I have been informed, by the kindness of the Assistant-Secretary of the Royal Astronomical

Society, that the times of sunrise at Upsala and Innsbruck, respectively, about 1st June, are as follows:—Upsala, 2 h. 50 m., G.M.T.; Innsbruck, 4 h. 6 m., G.M.T. From this, it appears that, at both places, according to the observations of Linnæus and Kerner, the flowers of *Tragopogon* open within from an hour to two hours after sunrise. At St. Moritz, sunrise takes place a few minutes earlier than at Innsbruck; yet, according to my observations made there, the flowers did not open much before 8 A.M., considerably over three hours after sunrise; from which I conclude that either I failed to observe the opening early enough, or the hour of opening was retarded, in some way, by the great elevation (over 6000 ft.).—M. C.

THE INDO-MALAYAN SPECIES OF JUSSIÆA.

By Henry N. Ridley, C.M.G., F.R.S.

The genus *Jussiæa* comprises a considerable number of marsh-loving herbs with yellow or rarely white flowers; the greater number are South American, but some occur in Africa and Australia and a limited number in Tropical Asia. Of these the following are Indo-Malayan:—

1. J. repens L. (Sp. Pl. ed. 2, 555; Fl. Zeyl. 169), an aquatic plant with white flowers, is sufficiently well known.

2. J. suffruticosa L. (Sp. Pl. *l. c.*), is based on the figure and description of Rheede (Hort. Malab. ii. ~~55,~~ t. 49). Linnæus gives as synonyms "Ludwigia capsulis oblongis uncialibus Roy. Lugd. 252; Raii Hist. 1510" and "*Lysimachia* indica non papposa, flore luteo minimo" Herm. Lugd. 396: these descriptions are based on Rheede's figure, which is quite a good one. Linnæus, however, describes the plant thus: "Jussiæa erecta villosa, floribus tetrapetalis octandris pedunculatis." Rheede says nothing about its being villous, nor does he so represent it, though he uses the word *mollis*, by which I take him to mean thin or tender. There is no specimen in Linnæus's herbarium, nor does it appear that he ever saw the plant, but there can be no doubt as to what was the plant intended by Rheede. It is remarkable *inter alia* for its slender cylindric angled fruit and its very small corolla, hardly ·2 in. across, the petals being much shorter than the sepals. Very unfortunately Hooker, Clarke, King, and most later botanists lumped together the whole of the Asiatic species under the name of *J. suffruticosa* L., regardless of whether the corolla is barely ·2 in. across or 3 in. wide or the capsules slender and cylindric or obconic. Haines (Journ. As. Soc. Beng. xv. p. 313, 1919) describes and figures a plant under the name of *J. fissendocarpa*, from a peculiar character in the seed, quite unlike anything in the other Asiatic species, which he was the first to point out. This plant is identical with the commonest species in the Malay Peninsula, and Haines also gives it from Purnea and Bengal, and a specimen has recently been received at Kew from Malabar (Rheede's old locality); and this plant is undoubtedly Rheede's plant and the true *J. suffruticosa* L. The comparative rarity of the plant in India

probably accounts for its having been overlooked by the Indian botanists.

J. suffruticosa (*J. fissendocarpa* Haines) may be described thus:—A herb, simply branched or compound-branched, sometimes slightly woody at the base, slender, 1 to 2 feet tall, quite glabrous; branches slender, winged. *Leaves* lanceolate, narrowed to the tip and base, thin and membranous, ·5 to 3 in. long, ·25 to ·5 in. wide; petiole slender, winged nearly to the base. Pedicel with ovary ·5 in. long. *Sepals* 4, very narrow lanceolate-acuminate, ·1 in. long. *Corolla* shorter, yellow; petals very small, ·1 in. or less long, subrhomboid, base narrowed but not clawed, narrowed and blunt at tip. *Stamens* 8; style cylindric; stigma capitate. *Fruit* cylindric with persistent sepals ·75 in. long, ·1 in. through. *Seeds* in upper part ellipsoid, smooth, pale, in the middle larger and slightly corky, at base much larger, oblong with a groove on one side, corky.

Hab. India, Purnea and Bengal (*Haines*); Malabar (*Herb. Kew.*); Siam, Bangkok (*Kerr* 4041); Malay Peninsula, Singapore, very common Kelantan, Glam Woods and Chaning. Penang (*Curtis*); Christmas Isle one plant (possibly introduced accidentally from Singapore); Philippines, Paragua (*Merrill* 797), Mindanao (1021), Luzon (*Cuming* 655 and 1055, *Loher* 2166, 2167).

J. tenella Burm. Fl. Ind. 103, pl. 34, fig. 2, Java, may possibly be this, but it might be *Ludwigia perennis* L. The plant has the habit of *L. perennis* and equally small flowers, but it has the stamens of *Jussiæa*. According to description, *J. fruticosa* DC. Prodr. iii. 57, is probably *J. suffruticosa*; it is a native of Cochin China. I found a very succulent form of *J. suffruticosa* near the sea at Galang, in Singapore, with a thick fleshy stem and broad elliptic, long-petioled leaves 1·5 in. long, ·6 in. wide, the petiole ·5 in. long; this seems to me a seashore form.

3. JUSSIÆA ERECTA L. Fl. Zeyl. 170; Sp. Pl. 556, is based on the "Herba vitiliginum" of Rumph (Herb. Amboin. vi. p. 49, t. 21, fig. 1), on which drawing and description Lamarck also based his *J. angustifolia* (Lam. Dict. iii. 331; Ill. t. 280, fig. 3). This species is also referred to *J. suffruticosa* by Hooker, Clarke, and King. There is a drawing of what is clearly intended for this in Rheede's Hort. Malab. ii. 97, t. 50, but Lamarck refers this to his *J. villosa*. Linnæus (Sp. Pl. 556) unfortunately added to his synonyms three references to South American plants, and gives as habitat "in America et forte in Virginia." *J. Blumeana* DC. Prodr. iii. 55 and *J. Junghuhnii* Miq. Fl. Ind. Bat. i. 1, 627 from Java seem from description to be *J. erecta*.

J. erecta is often tall, up to 3 or 4 feet, but dwarf forms occur. It is quite glabrous or may be sparsely hairy, especially on the young parts. The stem is fairly stout, angled or slightly winged and simply branched. *Leaves* lanceolate-acuminate, long-narrowed at the base; nerves ascending, 14 pairs slightly elevate beneath; midrib and nerves often more or less sparsely hairy, 2 to 4 in. long, ·25 to 1 in. wide. Ovary and pedicel ·5 in. long. *Sepals* 4, ovate acuminate, ·12 to ·2 in. long, increasing in fruit to ·3 in. long and ·12 in. wide; nerves prominent 3, hairy. *Corolla* 1·25 in. wide, bright yellow; petals obovate, clawed, slightly emarginate. *Stamens* 8. *Style* short and thick. *Fruit* oblong obcuneate glabrous, broadest at the top and narrowed to the pedical, ·75 in. to 1 in. long, ·25 in. through at the top; pedicel ·2 in. long. *Seeds* not corky, ellipsoid, polished mahogany-brown.

Hab. Marshes and ditches. India, Belgaum (*Ritchie*), Concan (*Stocks*); Siam, Chiengmai (*Kerr*); Malay Peninsula, Singapore, Tanglin (*Ridley* 10699), Tanjong Katong, a dwarf form in coconut estates; Malacca (*Griffith*); Pulau Besar (*Maingay*); Kelantan, Chaning; Kota Bahru (*Ridley*); Penang Hill (*Wallich* 6333). Java (*Zollinger* 112). Borneo, Sarawak (*Haviland*); Timor (*Curtis*); Philippines (*Cuming* 655). New Guinea, Mt Scratchley (*Macgregor*); Kaiser Wilhelm's Land (*Weinland*); Mt. Carstensz (*Kloss*). Australia, near Darwin (*Allen*). China, Hainan (*Ford* 356); Yunnan (*Henry* 11281).

Var. *exaltata* Roxb. Hort. Beng. 33, Fl. Ind. ii. 401. This seems to me to differ only in the more hairy leaves which have numerous short hairs on both sides. It is the commoner form in India, and occurs at Coimbatore and also in Ceylon (*Col. Walker*, *Gardner*).

4. JUSSIÆA VILLOSA Lam. Encyc. iii. 331. I have seen no type of Lamarck's plant; he gives Rheede's "Catta Carambu" (Hort. Malab. ii. 97, t. 50) as a synonym, but this plant is not hairy, and is certainly *J. erecta* L. and Lamarck's *angustifolia*. This has been confused with *J. speciosa*, which has much larger flowers and very different sepals and capsules.

Stem tall, densely hairy. *Leaves* lanceolate, narrowed to base and tip, sessile hairy all over, the hairs longer than in *L. speciosa*, 3 in. long, ·1 in. wide. *Sepals* ovate acute, ·3 in. long, ·1 in. wide at base, hairy outside. *Corolla* ·75 in. wide; petals oblong-lanceolate retuse, ·25 in. wide. *Fruit* thickly cylindric, base narrowed, hairy, 1·25 in. long, ·25 in. through. Seeds dark red, ellipsoid grooved.

Hab. India, Canara (*Hohenacker* 646), Anamallaya (*Beddome*), Coromandel (*Koenig*), Maisor and Carnatic (*Thomson*). Singapore, Alexandra Road (*Ridley* 5729)—the capsules in this plant quite slender, 1·5 in. long, ·2 in. through, cylindric and hairy, widened at the tip; Cambodia, Ile de Phuquoc (*Godefroy-Lebeuf*); Borneo, Sarawak (*Beccari* 3244); Timor (*Mus. Par.*); Philippines, Negros (*Elmer*). Australia (*Banks & Solander*).

Jussiæa speciosa Ridl. n. sp. *Herba* alta undique tomentosa hirsuta 1·2 to 2·2 metralis. *Folia* lanceolata lata utrinque attenuata; nervis ultra 20 paribus, 9 cm. longa, 2·5 cm. lata vel minora petiolis mm. longis. *Flores* singuli sessiles axillares. *Sepala* triangularia acuminata cuspidata extus dense hirsuta 1·2 cm. longa, 6 mm. lata ad basin. *Corolla* lutea, 8 cm. lata. *Petala* obovata ·1 cm. lata. *Stamina* 8. *Capsula* obconica dense tomentosa hirsuta 2 cm. longa, 6 mm. lata, semina minuta ellipsoidea rubra polita.

Hab. S. India, Malay Peninsula.

A tall plant, 4 to 6 feet high, densely softly tomentose hairy all over. *Leaves* lanceolate, broad, narrowed at both ends, 4 in. long, 1 in. wide; nerves over 20 pairs; petiole short, distinct, ·25 in long.

Sepals triangular acuminate, cuspidate, densely hairy outside, ·5 in. long, ·25 in. wide at base. *Corolla* bright yellow, 3 in. wide. Petals large ovate, ·5 in. across. Capsule obconic, densely softly hairy and crowned by the large sepals ·9 in. long, ·25 in. through at the top. Seeds ellipsoid, not grooved, red.

Hab. India: Wynaad, swamps at Kalpatty (*Beddome* 3149); Nilgherries, Devala (*Gamble*); Ceylon (*Thwaites* 3297)—I saw it by the edge of the Kandy Lake many years ago; Singapore, Balestier (*Ridley*).

This, the finest of our species, can only be confused with *J. villosa* Lam., from which it is readily distinguished by its large triangular long pointed sepals, very large flowers, and obconic capsule.

ON COLLECTING LINEAR-LEAVED AQUATICS.

By W. H. Pearsall.

[The following notes appear in the recently-issued Report of the Watson Exchange Club, and are here reprinted by permission of the editor, Mr. H. S. Thompson, in order that they may obtain that wider circulation to which their usefulness seems to entitle them.—Ed. Journ. Bot.]

"Dredging. The most interesting of these species are usually invisible from the surface, and grow only on the finest and softest muds at depths up to twenty feet. Hence the necessity for a dredger. The dredger is thrown out and the boat rowed on a few strokes to obtain sufficient "drag" before hauling in. This is done slowly and uniformly so that the hooks hold the bottom and uproot entire plants. The best results are obtained by dredging from the deeper water to the shore—i. e., *up* the slope—rather than in the contrary direction.

"When botanizing on land it is always advisable to carry a long piece of string in the pocket. A large stone attached to the end of this will provide means whereby species growing out of reach in water may be readily secured.

"Floating-Out. After removal from the water the plants *must be kept wet* until you reach home. My own collection is usually done from a boat, and the plants are put at once into my vasculum with water at the bottom and kept shaded as far as possible during the rest of the day. Linear-leaved aquatics placed in a dry vasculum and left exposed to direct sunlight will be irretrievably ruined in a short time. In the absence of a vasculum the plants should be placed under the stern seat in the water usually found there, and upon landing rolled in damp dock-leaves or moss. At home the plants are put at once into a plentiful supply of water and may there be left until next day. If, however, they are to be sent to a referee they must be posted same day in a tin quite full of damp moss and aquatics.

"For mounting I use zinc trays (18″ × 11″ × 3″), but any large vessel full of water will suffice. Place the sheet of white mounting paper under the surface and see that it is entirely submerged—select one complete plant and place it upon the paper, both being submerged. With a pair of fine-pointed steel forceps coax the leaves and branches to assume a natural position—with leaves and fruits well displayed. (The forceps are useful in detaching caddis-cases, dirt or other foreign matter.) Then with the right hand take hold of the bottom of the paper and gradually raise it out of the water, when the root will adhere to the paper. Now take hold of the top of the paper with the left hand and very slowly raise the whole sheet—as a slightly inclined plane—out of the water, which will thus run off at the top and leave the whole plant adhering to the paper. Care is required, as the water finally escapes, to prevent the linear leaves from running together and spoiling the effect, but a little practice and patience will soon overcome this difficulty.

"Drying. Dry paper and plant together in the press. The best results are obtained by putting blotting-paper directly over each plant, whatever other paper is used in addition. Change the paper after two or three days. Great care is required in changing—the blotting-paper should be lifted slowly from the root to the apex of the plant, and not in the opposite direction. When the whole plant is exposed, straighten out any folded leaves, re-cover with dry paper, and change again in a week. After that the plants may be left for a much longer period. When the plants and their paper-mounts are stone-dry (test with the back of the hand) they should be enclosed in folded covers of thin paper, and thus protected they keep indefinitely and can be readily examined. On no account should gum or other adhesive be used for mounting—water and adequate pressure are amply sufficient."

ELISIA—AN OVERLOOKED GENUS-NAME.

By A. B. Rendle, D.Sc., F.R.S.

Mr. C. D. Sherborn has kindly drawn my attention to vol. iii. of the *New Orleans Medical & Surgical Journal* (1847), the March number of which contains (pp. 614–16) a paper of botanical interest (no. vii) entitled "Description of a New Genus of the Family of Solanaceæ, with Remarks on its Characters and Properties." The paper is signed Milano, which is probably a pseudonym, as no author's name is given in the list of original communications at the beginning of the number, nor in the index at the end of the volume. Mr. Sherborn tells me that copies of this American Journal are rare in this country; the volume in question had been lent by the Manchester Medical Society. At any rate Milano's genus seems hitherto to have escaped the attention of botanists; it does not occur in the *Index Kewensis*, and is not quoted by Dr. W. E. Safford in his recent Synopsis of the genus *Datura* (Journ. Washington Acad. Sci. xi. 173, April 1921). It may therefore be worth while to reproduce the more important part of the publication, especially as one or more of the trivial names may have to be seriously considered by the monographer:—

[*New Orleans Medical and Surgical Journal*, vol. iii. 614–16 (March 1847).]

"VII.—DESCRIPTION OF A NEW GENUS OF THE FAMILY OF SOLANACEÆ, WITH REMARKS ON ITS CHARACTERS AND PROPERTIES.

". . . . In this family some of the species are trees, others are shrubs, or herbaceous plants, and they differ so much in appearance and external characters, that it is very difficult to arrange them all in the same classification. Some of the genera, indeed, contain species which depart so far from the characteristic forms, that we must necessarily separate them. Thus, I made some observations on the genus *Datura*, or rather on some particular species of this genus living only in the warmest regions of the globe. It seems that the Daturas have not been very well studied in the aspect and various properties which they present in the tropics. Some of these have characteristic features so peculiar that they cannot with propriety be longer retained in this genus—they evidently belong to different groups, and have distinguishing generic characters.

"I have, therefore, separated some species, forming a natural group, from the true Daturas, and have formed of them the new genus *Elisia*, in memory of a much esteemed friend.

"GENERAL CHARACTERS OF ELISIA.

"*Elisia* calice monopetalo, anguloso, longitudinaliter fisso et persistenti; corolla monopetala, margine quinque-punctata, subcampanuliformi, prismatica, marcescenti.

"The Elisias are very elegant shrubs, with foliage of a light and lively green, their large terminal, snow-white, campanulate, and pendulous corollas produce a most charming and picturesque effect. They grow in fresh and fertile soils, but their shade is not only dangerous to animals, but injurious to the plants which vegetate in their vicinity. In the evening, and during the whole night, they exhale a nauseous, soporific, and carbonic odour, which must be injurious to respiration if in a great quantity, but a few flowers produce in a large open room, an agreeable perfume.

"SPECIFIC CHARACTERS.

"ELISIA FORMOSISSIMA Nobis. *Datura arborea* Lin.

"*Elisia* pericarpio subspinoso, scabro, quadrivalvi, et quadriloculari, foliis elliptico-ovatis, subtus leviter villosis, longe petiolatis lateraliter nervosis, parum subdentatis.

"We thought convenient to change the specific name of *arborea* to *formosissima*, the first is applicable to all the species, and on that account objectionable, the second expresses the charming effect which this beautiful shrub produces. Every one that has observed it in its native country, will certainly agree with us in adopting the specific name of *formosissima*. This plant, quite common in Venezuela, reaches the height of twenty feet or more, and is very well formed. Its large and smooth leaves are slightly villose in their inferior part: but what particularly strikes the traveller, is its numerous flowers, which hang in a graceful form, so as to cover the whole plant with a snowy hood. Its wood is useless.

"ELISIA MUTABILIS Nobis. *Datura Bicolor* Mor.

"*Elisia* pericarpio scabro quadriloculari, quadrivalvi; foliis ovatis atrovirentibus, mollibus, crasse petiolatis, serratis; flore mutabili.

"This little shrub though apparently like the preceding, is nevertheless less elegant in its form, less lively in its colour, its exhalation is more injurious to the lungs, and has more dangerous qualities. It is not so high as *E. formosissima*, and it seems diminutive in all its exterior appearance. Its corollas are not precisely of two colours, as indicated by the specific name, *bicolor*, given to it by the Botanists; but it changes in the different hours of the day, passing from the whitish to the reddish or yellowish colour, and we observed these different gradations of hue in the same plant, and at the same hour. Hence, we have called it *E. mutabilis*. This effect is produced by the influence of light, which induces chemical changes in the fluid. Whoever observes this curious phenomenon for the first time, will certainly be surprised, and consequently may be deceived by the illusory appearance, if he does not examine it attentively at different times.

"ELISIA LACINIATA Nobis. Species Nova (?).

"*Elisia* pericarpio rufido, quadrivalvi, biloculari; foliis sublaciniatis breviter petiolatis, glabris.

"This elegant shrub may be said to be a diminutive of the first species in its dimensions and properties. It is woody, perennial, with its bark lighter yellow than the *E. formosissima*. It is particularly distinguished by its deeply cut, glabrous, petiolate leaves. The colour of its subcampanulate and prismatic corolla is unchangeable, except in the warmest hours of the day.

"*Medical properties.*—The inhabitants of the plains of Venezuela and Nueva Grenada, use the leaves and flowers of *E. mutabilis* and other Elisias in making a potion or smoking it as we do with tobacco. Some experiments, made by my friends and myself, confirm the common opinion of their beneficial effects in cases of asthma. The Indians stupefy and kill their enemies with a kind of starch or white powder which they extract from its seeds. . . . I have obtained from the leaves, flowers, and tender branches of the above mentioned three species of *Elisia*, a fine white powder, with bitter, nauseous and caustic taste: treating it with sulphuric acid, it crystallizes in an acicular form, giving fine shining needles of sulphate of elisine, which name I have adopted in the belief that elisine and daturine are essentially different. It is very like daturine in its external appearances, but I have had no opportunity of making comparative experiments to determine its specific characters.—MILANO."

Botanists familiar with the genus *Datura* will note that the proposed new genus, *Elisia*, is synonymous with *Brugmansia* Persoon (Synops. Pl. i. 216, 1805), with which name Milano was presumably unacquainted. The new name is therefore unnecessary even though we agree with Persoon and Milano in segregating the South American tree Daturas as a distinct genus. Dr. Safford maintains the more general practice of regarding the group merely as of sectional value.

In two out of three species Milano has "thought it convenient" to alter the trivial owing to the non-distinctive or misleading character of the original species name. He did not appreciate that a name is a mere label which, if regarded as descriptive, may be misleading or even ridiculous—as Professor Flahault happily expressed it at Vienna in 1905—"we have a daughter and we name her Blanche; she grows up and has black hair but we do not change her name!"

In his synopsis of *Datura*, Dr. Safford describes several new species and suggests some new combinations in the section *Brugmansia*. It will be interesting to know just where he places Milano's names; provided that the descriptions are adequate. I have been unable to trace "Datura bicolor Mor." (Persoon has *Brugmansia bicolor*); Milano's description suggests the plant named by Safford *D. versicolor*; if this is correct, *mutabilis* might have to take precedence as the trivial.

SHORT NOTES.

Ruscus aculeatus L. During the last twelve years I have had a plant of the Butcher's Broom under observation, as it was frequently examined and shoots cut off for class-work on cladodes. The plant is a pistillate one; no staminate flowers have been noticed and fruit has not been produced till this year, when a single berry was observed. There are no staminate plants in the neighbourhood; in fact, the specimen examined is the only one known in the near vicinity. A probable theory to account for the production of this single berry is that stamens had been formed on the pistillate plant. Near Dartmouth the pistillate plants are often full of berries, but staminate plants are always present when this abundance of fruit has been noted. The rarity of fruit on pistillate plants when staminate ones are absent shows that the plant is normally diœcious, and that its subdiœcious character is very slight.—W. Watson.

[See p. 85 and Mr. Linton's note on the plant in this Journal for 1916, p. 66.—Ed. Journ. Bot.]

Impatiens glandulifera Royle. Since writing my note on the white-flowered form of the plant (Journ. Bot. 1920, 201), I find that it was figured and described by Lindley (Bot. Reg. xxvii. t. 20; 1841) as *I. candida*, which is placed by J. D. Hooker (Fl. Brit. Ind. i. 469; 1872) under *I. Roylei* Walp. (=*glandulifera* Royle) as var. *candida*. For the first time since I have grown it, some specimens have this year departed from the pure white blossoms which have hitherto characterised the plant. In these the flowers are pale lilac, closely resembling those of the figure in Bot. Mag. (1899) 7647, there described by J. D. Hooker as *I. Roylei* var. *pallidiflora* (he writes of the flowers as "pale rose"). The flowers however are destitute of the red speckles which are mentioned in Lindley's description and shown in the figures cited. Whether the plant be entitled to varietal rank is, I think, very doubtful; in any case the name *candida* must replace *alba*, proposed by me in the note referred to above. I may add that the drought this year has affected my plants very unfavourably; they are comparatively short and generally unhealthy, and are perfecting little seed. A similar variation in colour is observable in

Mr. Shoolbred's garden at Chepstow, but there the plant has not been so much affected by the weather.—JAMES BRITTEN.

A CORRECTION. In the last line of my note (p. 236) on *Sparganium angustifolium* Michx., the word *affine* should be omitted.—A. BENNETT.

REVIEWS.

Mutations and Evolution. By R. RUGGLES GATES, Ph.D., F.L.S. *New Phytologist* reprint, No. 12. Wm. Wesley & Son. 6*s*.

IN this memoir Dr. Gates takes up an eclectic attitude, while at the same time emphasizing the part mutation has played in the evolution of plants and animals—an emphasis only to be expected from one who has published so much valuable work in support of the mutation thesis. He notices the failure in universality of those who would ascribe only one cause—Lamarckianism or Natural Selection or crossing or mutation, &c.—to the phenomenon in question, holding that "many of these factors and perhaps all, may be reasonably claimed to have had some share in the evolutionary result." We have chapters on the mutation concept, on the effects on organisms of the appearance of an extra chromosome, on the limitations of the cell-theory, on the recapitulation theory, and on the inheritance of acquired characters, in which latter the revulsion from Weismann's non-inheritance conception is supported. But the plain botanist will perhaps turn with greater interest to the chapter on parallel mutations and that on presumptive mutations in wild and cultivated plants. All these subjects are handled in a brief but capable manner, every point being clearly stated and cautiously opened out, although it may sometimes be difficult to agree fully with the author's conclusions. The possibility Dr. Gates suggests of the *Aquilegia* flower having arisen as a peloric mutation from a zygomorphic ancestor, although ingenious is scarcely convincing; for on the analogy of *Halenia*, a genus with species having nectarial projections at the base of the corolla ranging from five mere gibbosities to as many long spurs, and bearing in mind the almost universal actinomorphy obtaining in the *Ranunculaceæ*, the *Aquilegia* spurs would seem to be better explained as deepenings of primitive honey-secreting nectaries brought about by simple Natural Selection, inasmuch as the deeper the receptacle the more honey it would hold, and thus the greater the chance of cross-pollination by insect visitors.

There can be no two opinions as to the value of this concise and well-written memoir, especially in view of the appended bibliography amounting to nearly two hundred items—surely enough to satisfy the most avid enquirer into the subject!

S. M

British Wild Flowers in their Natural Haunts described by A. R. Horwood; with sixty-four plates in colour representing 350 different plants from drawings by J. N. Fitch and many illustrations from photographs. Six volumes imperial octavo, cloth boards, each 12*s.* 6*d.* net. Gresham Publishing Company.

The publishers have done all in their power to make this handsome work a success. It is admirably printed, and neatly bound; the coloured plates are well executed and accurate, although they convey the impression that Mr. Fitch is better acquainted with pictures of plants than with the plants themselves, and the illustrations from photographs of living examples, though sometimes feeble, and not always accurately named—e. g. *Delphinium Ajacis* (ii. 94) are in the main satisfactory. The weight of the volumes is their only drawback; the first weighs nearly 2½ pounds, and the others are like unto it.

Had the text risen to the level of the accessories, the book might have formed a useful addition to the already numerous volumes devoted to the popularisation of British botany; but truth compels us to place it in the category of lost opportunities. As we said when noticing Mr. Horwood's earlier volume *The Story of British Plants* (1913; see Journ. Bot. 1914, 78) there is still room for that companion to the *Student's Flora* indicated by Sir Joseph Hooker more than fifty years ago in the preface to that work, which should summarise the "physiological and morphological observations on British plants" that even by that time "had given an impulse and zest to botanical pursuits"; but Mr. Horwood has been content for the most part to follow in the well-beaten track which he had already trodden in the book we have mentioned, as well as in his later volume *Practical Field Botany* (reviewed in this Journal for 1915). The matter of the work now under notice is to a large extent a repetition of what appeared in those books, and the criticism applied to them in these pages by two different reviewers applies equally to the present volumes, both with regard to matter and manner. As to the latter, the examples quoted from both books are abundantly paralleled in this; it is astonishing that none of Mr. Horwood's friends have taken him in hand, or that he himself has not profited by the criticisms which have been passed upon his style.

The arrangement of the work is somewhat puzzling. The first volume begins with an "analytic summary," in which "the essential specific characters of the 347 species described in greater detail, as life-history studies, in vols. ii.–v. are given in technical language." Summaries of the natural orders and genera (these very brief) appear as appendixes to vol. v.; while vol. vi. contains "full descriptions of the British species, not described in greater detail in vols. ii.–v.," and also an appendix of plants which "should have been included in the text." We fail to see the advantage of this plan over the ordinary systematic arrangement; even the index does not bring the scattered information together, as neither genera nor orders are included in it.

The "analytic summary" starts with what is styled an "explanation of scientific nomenclature," from which we learn that "Linnæus's greatest work lay in his invention of the binomial system," "by the very establishment" of which "it was at once recognized that there are genera and species." Such nomenclature, we are rightly informed, "dates from 1753, when *Species Plantarum* was published," but it is somewhat surprising to be told that "the adoption of the plant names given at this date in preference to later names is due to Mr. G. C. Druce in this country (in 1905)" (p. 3). Of the definitions the following is an example:—"A *genus* is a collection of species which, originally individuals all of the same type or species, have by degrees become so markedly divergent that they represent a number of different species, but sufficiently closely related to be included in the same genus": incidentally we learn that "there are Benthamian or Linnean or comprehensive species, and Jordanean (*sic*) or elementary species"; "it is essential to remember that the *species* is the ultimate individual or unit from which a starting-point can be made." The subject of nomenclature is resumed at greater length in the section (pp. 198–213) on "The Names of Wild Flowers," which begins with references to the title (rendered into English) of works by early writers—"Lobelius, *Notes of Plants*, 1616" puzzles us—and includes remarks on the origin of English names—"The monks in the learned English period used the Latin *Plantago* and transformed it into Plantain"—Linnæus's rules for nomenclature, and selections from the Vienna Code. The chapter ends with some remarks on popular nomenclature—"Synonyms cannot be associated together under some one plant, and relegated to oblivion, because in this case there is no science of nomenclature, and names are constantly being duplicated for the same plant, whilst in other cases one name does duty for several"—and the language of flowers—"Ivy has been made the emblem of love and fidelity from its clinging habit (*cf.* Iseult and Tristan)." A chapter on "The Folklore of Plants" contains even more nonsense than is usual in such chapters; and the volume ends with an account of "Plants and their Uses to Man," the most notable feature of which is the enumeration of the "various ways in which British plants may be turned to economic advantage"—*e. g.* "Spices are afforded by Clove Pinks, Melilot, Herb Bennett, Salad Burnet, Celery, Caraway, Mugwort, Absynth, Ground Ivy. . . . Mats, rennet, soda, rushlights, formerly flashlights for fireworks, stuffing for casks, mattresses, cushions, or packing for glass and china, and wicks, are a few miscellaneous uses."

"Volumes II to IV"—we quote from the prospectus—"are devoted to the special description and illustration of the 350 selected types, arranged under their several groups. Thus, Volume II deals with Fields and Meadows, Cornfields, and the Sea Coast; Volume III with Woods and Copses, and Roadsides and Hedges; Volume IV with Hills and Dry Places, Lakes and Rivers, and Waste Places; Volume V with Bogs and Marshes, Heaths and Moors, and Rocks and Walls."

Considering how few plants are confined to any one of the habitats indicated, such classification strikes us as unsatisfactory. Each section begins with a summary of the plants it comprises, written in a style of which the following is a sample: "Where the meadows roll into uplands and make rambling ramparts carved by Nature's hands rise the lemon-tinted clusters of Hop Trefoil, giving a touch of gold to the external green of the meadows. . . . Trailing over the ridges in the shires or on banks on the uplands the Cinquefoil scrambles over the scrubby grass, lending a new shapeliness to the outlines of the meadow lands with their stereotyped fascicles of short-stemmed grasses" (ii. 4).

The descriptions are on the whole well done, and contain notes on fertilisation and kindred matters which, if not original, are carefully compiled; we are surprised to find no reference to the viviparous leaves and proliferous flowers of *Cardamine pratensis*. It is not easy to see on what principle the species have been chosen—*Camelina sativa* and *Cynosurus echinatus*, with others whose claims to inclusion among "British wild flowers" are equally slight, seem out of place when only 350 species are selected for detailed description. The long lists of popular names are taken bodily and unintelligently from the *Dictionary of English Plant-Names*, and we suspect the lists of insect visitors and fungus-pests are from some equally convenient source: they contribute materially to filling the book—under the Crab-Apple (iii. 174) more than half the page is occupied by these three lists. We referred to this matter as it relates to plant-names in this Journal for 1914 (p. 80), so there is no need to pursue it, nor need we animadvert on the scraps of folk-lore, quotations from "a writer" and the like, mostly from Mr. Horwood's earlier work. He is at his worst when dealing with ecclesiastical matters: what can be more absurd than this: "Formerly young women dressed in white and walked in procession on the Feast of Purification, saying:

'The snowdrop in purest white array
First rears her head on Candlemas Day'" (iii. 125)

the lines being a quotation from Forster's *Perennial Calendar*, published in 1824? or that *Barbarea* "was formerly said to have formed the Crown of Thorns,"—it is only fair to say that he adds "but this seems unlikely" (iii. 135); doubtless its name "Herb Trinity" led to the (false) inference that the Heartsease "was used as a decoration on Trinity Sunday" (ii. 109). These are small matters, but newspapers and popular books are flooded with rubbish of this kind, and Mr. Horwood has given them a mine whence they may draw.

The Bibliography appended to the fifth volume could hardly have been less useful had it been the wish of its compiler to make it so. There is nothing to show whether an entry relates to a volume, a pamphlet, or a paper in a magazine; no dates are given; and the classification is of the strangest—thus, under "Names of Plants, Nomenclature, etc." we find Lindley's *Introduction to Botany*, Coles's *Art of Simpling*, Linnæus's *Species* and *Genera*, Taylor's *Names of Places*, and Gerard's *Herball*; Pearson's *Hepaticæ*, West's *Algæ*, the *Student's Handbook of Mosses* appear under "General British Floras"; few of the volumes entered under "Folk Lore" have any relation to plants (Mrs. Lincoln's "Botany" (American) is among them); local Floras are entirely absent. The references to books in the Introduction to vol. vi. suggest doubts as to the author's acquaintance with the volumes he enumerates—the *Journal of Botany*, he tells us, "is largely concerned with nomenclature," and Mr. Hiern's "*Index Abcedarius*" (twice so printed) is described as "a handy pamphlet," no indication being given of its nature. The collocation is strange: "also useful are Pritzel's *Icones Plantarum*, Nyman's *Conspectus*, and De Candolle's *Prodromus*, as well as Just's *Botanisches Jahresbericht*." The titles given are sometimes so inaccurate as to be misleading—*e. g.* "Mrs. Arber's *British Herbals*"; and a "third" edition of *Topographical Botany*: what is "the *Oxford Plant List*"? (p. xvii).

The sixth volume contains a full index of species under both Latin and English names, but neither genera nor orders are included; there is no complete index to the plates, nor any reference to the general contents of the volume.

We had noted many other points for criticism, but this notice is already too long: it seemed, however, necessary to adduce evidence that our unfavourable opinion of this work is based neither on hasty judgement nor superficial investigation.

THE GENUS SEDUM.

THE new volume (xlvi.) of the *Journal of the Royal Horticultural Society* is mainly occupied by "An Account of the Genus Sedum as found in cultivation," by Mr. R. Lloyd Praeger, the value and importance of which it would be difficult to over-estimate. As readers of this Journal, in which some of his descriptions have appeared, are aware, Mr. Praeger has for many years made a special and intimate study of the genus as represented in cultivation: "to the best of [his] ability [he] ransacked the gardens of the world, until the war put an end to such activities." As a result he received and grew 151 species, 13 of which proved to be new and were described in this Journal for 1917–19. How exhaustive Mr. Praeger's work has been may be gathered from the fact that he only knows of four species at present in cultivation which he has not seen. Its value is immensely enhanced by the figures by Miss Eileen Barnes of every species of which fresh material could be obtained: in no other way could an idea of the variety presented by the genus be brought before the reader, and it would be impossible to speak too highly of Miss Barnes's work. The descriptions also, whenever possible, were taken from living plants and checked with the descriptions given by the original describer and by leading authorities. The introductory portion, dealing with the history, distribution, statistics, variation, cultivation and propagation and sources of material, is admirably done; the descriptive portion, occupying nearly three hundred pages, follows. This begins with an account of the genus, which is divided into nine sections, duly characterised, and proceeds to the full and careful description of each species and its varieties, synonymy, references to figures, notes on distribution, etc. The following notes relating to our British species will, we think, be of interest to our readers.

The first species (*S. roseum* Scop.; *Rhodiola rosea* L.) is very variable, and a number of names are placed referred to it: "our native form displays very little variation within the limits of our islands; it is the sub-var. *continentalis* of Maximowicz (Bull. Acad. Pétersb. xxix. 129) and appears to be the form which prevails on the European mountains, spreading to Iceland and Canada." This is placed under the first of the four varieties—*vulgare*, *elongatum*, *atropurpureum*, and *Tachiroi*—into which Mr. Praeger divides the species.

Under *S. Telephium* L., *S. purpureum* Link and *S. Fabaria* Koch are placed as sub-species. "When characteristic, [these] are easily distinguished, but there are many plants which one hesitates to refer to one form or to the other; whether this is due to crossing or not I cannot offer an opinion. The 'wild' British plants I have grown have all been *Fabaria*, but I do not attempt to go into the question of the distribution in the British Isles of the two forms. The confusion which seems fated to hang over the Sedums is here especially marked, as, for instance, when one receives from one of the ablest of field botanists roots of the Japanese *S. alboroseum* as a native *Telephium* from woods in Sussex" (p. 85). Equally remarkable was the sending to Kew of the female plant of the Himalayan *S. fastigiatum* from Hexham-on-Tyne, "where it grows in a school garden, and is supposed to have been found wild in Cornwall or Scotland!" (p. 55).

Of *S. anglicum* Huds., which, first described from English specimens, is a species of Western Europe ranging from Norway to Spain, a new variety—var. *minus*—is described from "a very pretty and distinct little plant, obtained in the garden of Mr. E. A. Bowles, at Waltham Cross" (p. 182).

S. album L. is regarded by Mr. Praeger as "seldom if ever indigenous in Britain." H. F. Parsons, in an interesting MS. note (1875) in the British collection of the National Herbarium, regards it as native on limestone rocks on the Mendips, and this view is maintained by R. P. Murray (Fl. Somerset, 144) as to the localities mentioned by Parsons, though elsewhere in the country he considers it introduced. The variety *micranthum* (*S. micranthum* Bast.) has been much misunderstood: "The occurrence of true *micranthum* in the British Isles appears to rest on Sowerby's Sussex record (Engl. Bot. ed. 3, iv. 53): I have not seen specimens. The diagnoses given by Babington (Man. Brit. Bot.) and [J. D.] Hooker (Students' Fl.) do not appear to represent *micranthum* Bast. at all. The Cork plant, as sent to me by several botanists, is only *brevifolium*" (p. 185). The reference throughout the paper to ed. 3 of *English Botany* as by Sowerby can hardly be considered accurate; the title of the book was preserved, but the third edition, as Mr. Praeger knows, was entirely the work of Syme; the "Sussex record" is his, and does not appear in Sowerby's original: the same applies to the note (p. 289) that *S. Cepæa* is "naturalised in Buckinghamshire." On the Cork specimens labelled *S. micranthum* from Isaac Carroll's herbarium in the British collection is a note in Carroll's hand: "var. *turgidum* foliis crassis of *S. album*. The leaves are much shorter and broader than in the type; petals also shorter . . . Sir W. J. Hooker in litt. July, 184 . . ."

Under *S. acre* L., *S. Drucei* Graebner, in Bot. Exch. Club Report for 1912, 160, is thus disposed of: "This is the common British *S. acre*, and I have elsewhere (Journ. Bot. 65 [55], 212) recorded the observations according to which I fail to distinguish between it and Continental forms of the same species" (p. 248). We were not previously aware that, "like the Houseleek and some other Sedums, it is often planted on houses as a preventive of fire."

S. sexangulare L. is noted as "naturalized in some places in England," and *S. rupestre* L. is similarly regarded, though "possibly native in the west." Mr. Murray (Fl. Somerset, 145) notes the abundance of the former on walls and banks near villages in that county, but says it has "no claim to be considered a native plant, and is not even thoroughly naturalized"; *S. rupestre*, however, he regards as native on cliffs and in woods.

Mr. Praeger hardly does justice to the distribution of *S. reflexum* L. in Britain when he limits it to "old walls and occasionally on rocks"; it sometimes occurs in quantity on hedgebanks and roadsides at some considerable distance from gardens, though it doubtless originated from them. Like the equally commonly cultivated *S. spurium*, this species has received an astonishing number of names: Mr. Praeger quotes fourteen as "some of those under which *S. reflexum* arrived from reputable sources" and a still longer list of described varieties: "a series such as that in my garden disillusions one as to the value of these, except so far as, in the native state, they may represent local races and be of interest geographically" (p. 270). "Var. *albescens* Haworth (Revis. Succ. 28), which figures in British floras, is described as having the leaves glaucous, those of the flowering shoots not reflexed, plant smaller and leaves more slender, and flowers pale yellow. In the last character alone does it seem to differ from all of my garden forms, many of which showed some of these characters, and several all of them except the last."

S. villosum L. "is very exceptional among Sedums in inhabiting damp ground: in the Botanic Garden at Leipzig, it maintains itself in marshy soil on the edge of tanks used for aquatic plants. . . . According to Werner, the plant is a partial carnivore, capturing insects by means of its glandular hairs" (p. 302).

The novelties described are few, Mr. Praeger's new species, as has already been mentioned, having been described in this Journal: as to these, readers may like to make the following corrections: *S. pyramidale* (J. Bot. 1917, 42)—a name admirably descriptive of this remarkable species—proves to be synonymous with *S. Chaneti* Léveillé (1908); *S. triphyllum* (J. Bot. 1919, 54) and *S. Mairei* (*tom. cit.*, 53) give way respectively to the previously published *S. Chauveaudii* and *S. Someri*, both of Hamet; the name *S. Cooperi* (*tom. cit.*, 49) proved to be preoccupied, and for this *S. bhutanense* is substituted. There are several new varieties and two or three new combinations.

Looking through the pages, we find many notes, which, did space allow, we should like to transcribe. It is interesting to know that it was the late Canon Ellacombe, who is commemorated in *S. Ellacombianum*, who first urged Mr. Praeger to undertake a revision of the cultivated Sedums. The *S. Praegerianum*, "a remarkable plant, unlike any other species in cultivation," having a stemless rosette of leaves and radiating decumbent flower-stems, "was raised at Edinburgh in 1913 from a pinch of seed taken from a dried specimen just received into the Herbarium, obtained by a native collector in Tibet at 12,000 feet elevation" (p. 73).

The paper is well printed and fully indexed. We are glad to note that the principal reference to each species is printed in black type.

The only defect in its production is the failure to use the page-headings for giving information as to what lies below them: we have often drawn attention to this too frequent omission, and shall continue to do so in the hope that this common defect may be avoided. It has doubtless occurred to the Royal Horticultural Society that they would do well to issue the paper as a separate volume, apart from the other matter contained in the Journal: if it has not done so, we venture to commend the suggestion to its notice.

BOOK-NOTES, NEWS, ETC.

The Kew *Bulletin* (1921, n. 3) contains a paper on "The Genera of Fumariaceæ and their Distribution," by Mr. Hutchinson, with key to the genera and list of species (excluding *Fumaria*) the distribution of which is also shown; the genus *Dactylicapnos* is revised and there are several new combinations. Mr. L. A. Boodle writes on "Ravison"—"a commercial term applied to oil-seed in England, [which] appears to be subject to considerable elasticity of employment"; "Decades Kewenses" (dec. ii.) contains descriptions of new species of *Berberis*, *Wercklea*, *Cotoneaster*, *Spiræa*, *Ducrosia*, *Emilia*, *Ardisia*, *Bassia*, *Teucrium*, and *Dracocephalum*; and there are obituaries of J. R. Drummond and R. A. Rolfe.

The National Collection of Type Cultures, formed last year by the Medical Research Council and stationed at the Lister Institute, has been extended to include fungi as well as bacteria. The British Mycological Society has appointed a fully representative standing committee to consider the ways in which the collection can be made most valuable and to advise and assist in all questions appertaining to fungi. It is proposed to collect and maintain cultures of fungi of importance in phytopathology, medicine, veterinary science, technology, and soil biology, types useful for teaching purposes and any rare or interesting species. The co-operation of all mycologists is earnestly invited, and in return every effort will be made to supply the needs of applicants for cultures. Cultures will be supplied on demand, so far as possible, to workers at home and abroad, and a small charge will be made to defray the cost of media and postage. Annual lists of the fungi in the collection will be published in the *Transactions of the British Mycological Society*. A set of type-slides of fungi will be kept in the Botanical Department of the British Museum (Natural History), in addition to a working set at the Lister Institute. All communications should be addressed to the Curator, Lister Institute, Chelsea Gardens, London, S.W. 1.

At a recent flower-show at Hayward's Heath, prizes were given for best-named collections of wild flowers. There were only two competitors, and, on the principle laid down in *Alice in Wonderland*, both had prizes. How far the second deserved the honour, may be gathered from a letter in the local paper in which it is pointed out that of the 21 specimens exhibited in the second prize collection, 10 were incorrectly named, the errors including "Meliot" for *Centaurea nigra*, *Habenaria bifolia* for *Stachys sylvatica*, "Dandylion" for *Sonchus arvensis*, and the like.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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A REVISION OF THE OLD WORLD SPECIES OF VELLOZIA*.

By Susie Greves, M.Sc.

(Thesis submitted for the degree of M.Sc. in Botany, London University.)

The Old World species of this genus are included in the section *Xerophyta* as defined by Bentham and Hooker in the *Genera Plantarum*, iii. 739–40.

Pax used the names *Vellozia* and *Barbacenia* in an opposite sense to that of Bentham and Hooker, depending for distinctive characters solely on the number of stamens; all species with six stamens are placed by him with *Barbacenia*, while those with more than six stamens come under *Vellozia*. This arrangement appears to be less satisfactory than that of basing the separation of the two

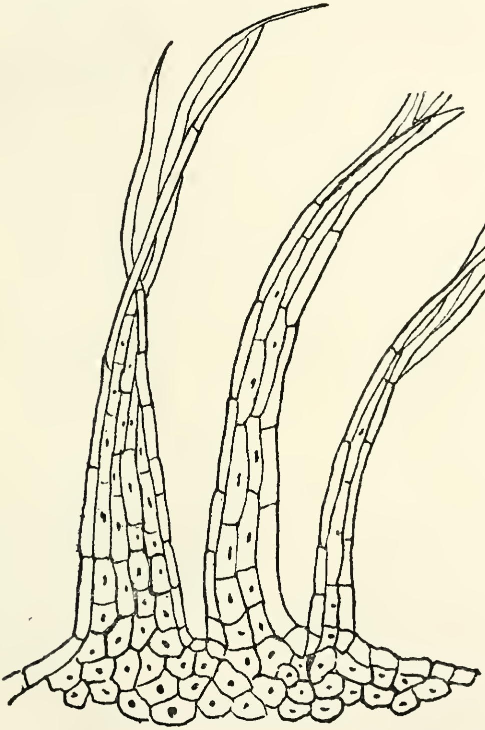

Fig. 1.—Section through hairs on surface of ovary of *V. villosa* (highly magnified).

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* This work was carried out in the Department of Botany, British Museum, at the suggestion of Dr. Rendle, to whom the writer wishes to express hearty thanks for his encouragement and criticism.

genera upon the difference in character of the perianth, those species in which the segments of the perianth are free down to the top of the ovary being regarded as *Vellozia*, while *Barbacenia* comprises those in which they unite to form a distinct tube.

The grouping of the Vellozieæ has hitherto been based upon the character of the caudex taken in conjunction with that of the leaves, perianth, or ovary-surface. A careful study of many species seems to indicate that the outgrowths present on the external wall of the ovary are sufficiently constant and characteristic to afford a simple and convenient method of grouping, and in some cases even of identification, of the different species.

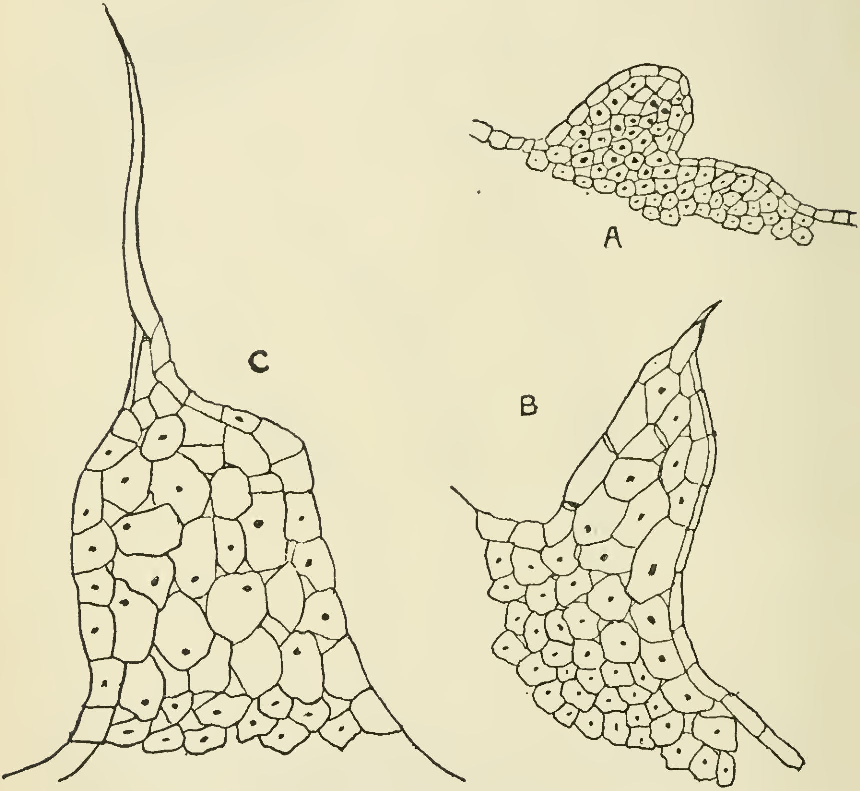

Fig. 2.—Section showing three stages (A, B, C) in growth of hairs on surface of ovary of *V. Eylesii* (highly magnified).

All these outgrowths are subepidermal in origin, and are composed of a central mass of cells surrounded by a single layer of epidermal cells, which is continuous with the epidermis of the ovary wall. Each outgrowth arises as a small papilla of hypodermal cells immediately below the epidermis. The cells rapidly increase in number and frequently in size, the growth of the epidermis keeping pace with that of the underlying cells. The cells beneath these outgrowths are very rich in cell-contents, and strands from the vascular bundles may be traced to them, indicating that there is special activity in this region. The ultimate form of the outgrowth varies considerably and appears to be constant for the different species.

In several species the papilla grows into a relatively long, thin, tapering process, resembling a hair. The central axis consists of one layer or more of hypodermal cells, long and narrow in shape and with few cell-contents, surrounded by a layer of elongated epidermal cells. When young the epidermis is continuous round the apex, but as growth proceeds the apical cell breaks and the outgrowth splits longitudinally into two or more strands, according to the number of rows of cells of which it is composed (fig. 1). Such outgrowths are

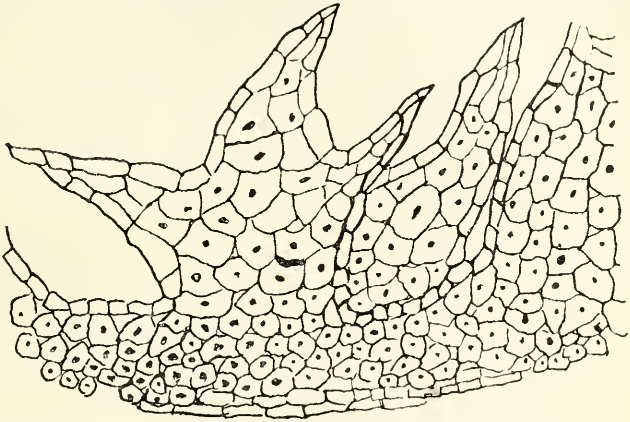

Fig. 3.—Longitudinal section through stellate hairs on surface of ovary of *V. suaveolens* (highly magnified).

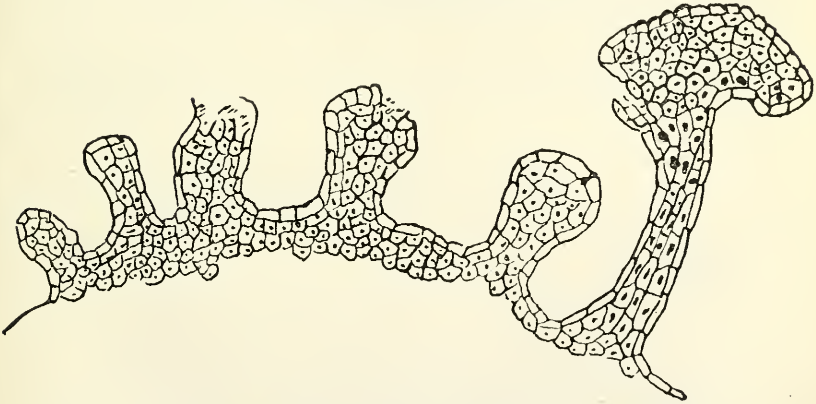

Fig. 4.—Section through capitate glands on surface of ovary of *V. viscosa* (highly magnified).

usually very close together and completely cover the surface of the ovary, to which they impart a soft villose appearance.

A more common form of outgrowth is that in which the basal portion is enlarged and flattened, while the apical cell grows out into a single, stiff, spinous or hair-like process. In some species these apical processes break off, leaving the surface of the ovary enclosed in a covering of stiff overlapping scales as seen in *V. Eylesii*, where the basal part is large and shield-like in shape (fig. 2). In other species, where the apical outgrowth is shorter and stronger, an extremely harsh echinate covering results.

Closely allied to this arrangement is the type found in *V. suaveolens*, where the basal portion is considerably enlarged but not flattened. Three or more projections arise irregularly from the surface, taking the form of short broad spines; the whole outgrowth resembles in outline, although not in structure, the stellate hairs of certain *Cruciferæ* and *Malvaceæ* (fig. 3).

Another modification of this form is that characteristic of the species having a viscous surface to the ovary. Here the usual papilla elongates and becomes slightly constricted round the base, while the upper portion is somewhat enlarged. The hypodermal cells forming the central portion are rich in contents and appear to elaborate a viscous substance, which ultimately breaks through the epidermis and covers the ovary with a viscous layer which dries in irregular masses, imparting a "warty" appearance to the surface of the ovary. This type is characteristic of *V. viscosa* (fig. 4).

One species, *V. elegans*, found in Natal and possibly in Madagascar differs from the other African species in having an ovary which is triangular in cross-section, and has a perfectly smooth surface. In both these respects it resembles many of the New World species.

It should be noted that the term "hair" as used in this paper is not confined to an epidermal outgrowth.

Key to African Species.

Series I. Ovary covered with soft long hairs.

Leaves filiform .... 1. *V. Hildebrandtii.*
Leaves linear.
  Leaves 10–15 cms. long, densely villose; peduncles 7·5–10 cms. long .... 2. *V. villosa.*
  Leaves 12–40 cms. long, pubescent; peduncles 11–17 cms. long .... 3. *V. Monroi.*
  Leaves 12·5–15 cms. long, upper surface glabrous, lower slightly hairy; peduncles 7·5–10 cms. long .... 4. *V. violacea.*

Series II. Ovary covered with stiff hairs.

*Leaves glabrous; ovary covered with bristles.
  Margin bearing short bristles. Leaves 7·5–10 cms. long; perianth-segments

3·8–5 cms. long; ovary covered with short lax bristles having broad overlapping bases .... 5. *V. clavata.*

Margin smooth. Leaves 1·5–3 dms. long; perianth-segments 3·5–4 cms. long; ovary densely covered with drab, subulate, wiry bristles (fig. 5). 6. *V. retinervis.*

Margin serrulate. Leaves 1·5–3 dms. long; perianth-segments 2 cms. long; ovary densely covered with short, stiff, tapering bristles .... 7. *V. Schnitzleinia.*

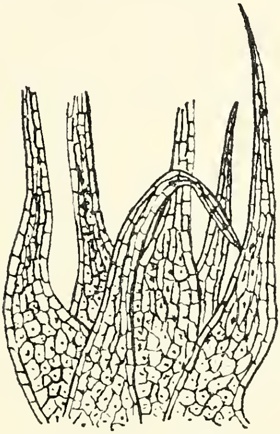

Fig. 5.—Section through hairs on surface of ovary of *V. retinervis* (highly magnified).

Margin serrulate. Leaves 5–8 cms. long; rush-like; perianth-segments 1·7 cms. long, attenuate and subulate at apex; ovary densely covered with stiff bristles............................ 8. *V. somalensis.*

**Leaves hairy or subglabrous.

A. Ovary covered with bristles.

Margin hairy. Leaves 3–6 dms. long, softly hairy on both surfaces; perianth-segments 3–4 cms. long; ovary densely covered with slender bristles. 9. *V. trichophylla.*

Margin smooth. Leaves 3 or more dms. long; slightly hairy becoming glabrous; perianth-segments 3·5–5 cms. long; ovary covered with minute, slender, brown bristles ...... 10. *V. equisetoides.*

Margin dentate. Leaves 1·5–4 dms. long; sub-glabrous or softly pubescent; perianth-segments 3–4 cms. long; ovary covered with short matted bristles .... 11. *V. Wentzeliana.*

B. Ovary covered with long stiff hairs springing from shield-like bases. Leaves 1–1·5 dms. long; inner surface pubescent, outer less so; perianth-segments 4·5–5 cms. long .... 12. *V. Eylesii.*

C. Ovary covered with stellate hairs. Leaves 2–2·5 dms. long; inner surface roughly hairy, outer surface glabrous; perianth-segments 5·5–6 cms. long .... 13. *V. suaveolens.*

Series III. Ovary rough, viscous, and glandular.

*Perianth-segments not more than 4 cms. long.

A. Leaves glabrous.

Margin ciliate.

Leaves 10–15 cms. long; margin finely ciliate when young; aristate; perianth-segments 3·2–3·5 cms. long. 14. *V. capillaris.*

Margin serrate.

Plant small; leaves 2·5–5 cms. long; perianth-segments ·6 cms. long... 15. *V. humilis.*

Leaves 5–12·5 cms. long; perianth-segments 1·8–2·4 cms. long .... 16. *V. rosea.*

Leaves 15–30 cms. long; margin stiffly serrate; perianth-segment 2·5 cms. long.............................. 17. *V. Schlechteri.*

Leaves 30 cms. long; margin thickened and finely serrate; perianth-segments 2 cms. long .... 18. *V. acuminata.*

Margin denticulate.

Leaves denticulate on both sides of midrib. Perianth-segments 2·5 or more cms. long .... 19. *V. scabrida.*

Leaves 12·15–15 cms. long; midrib not denticulate; perianth-segments 2–2·5 cms. long .... 20. *V. squarrosa.*

Leaves 15–22·5 cms. long; keel denticulate, viscous towards base ...... 21. *V. viscosa.*

B. Leaves hairy.

Margin hairy.

Leaves 7·5–12·5 cms. long, pubescent on both surfaces, few in tuft; perianth-segments 2·5 cms. long. 22. *V. tomentosa.*

Leaves 15–25 cms. long, finely pilose on both surfaces; 8–10 in tuft, perianth-segments 2·5 cms. long. 23. *V. velutina.*

Margin spinose.
Leaves 15–22·5 cms. long, slightly hairy; spinose beneath midrib; 6–8 in tuft; perianth-segments 2·5 cms. long .... 24. *V. Spekei.*
Leaves 30 cms. long, margin and under surface finely spinosely ciliated, perianth-segments 2·5 or more cms. long............................ 25. *V. hereroensis.*

**Perianth-segments more than 4 cms. long.
A. Leaves glabrous.
Leaves grass-like, 15–22·5 cms. long, margin finely serrate when young; perianth-segments 5–5·6 cms. long . 26. *V. Kirkii.*
Leaves 30 cms. long, margin denticulate when young; perianth-segments 5–6 cms. long............................ 27. *V. splendens.*
B. Leaves pubescent.
Leaves 12·5–20 cms. long; perianth-segments 4·5–5 cms. long .... 28. *V. æquatorialis.*

Series IV. Ovary glabrous.

Leaves 10–20 cms. long; perianth-segments 1·5 cms. long .... 29. *V. elegans.*
Leaves 3·7–5 cms. long; perianth-segments ·4 cms. long .... 29 *a.* var. *minor.*

Doubtful Species.

Leaves 15–21 cms. long, glabrous, scabrid on back; flowers unknown..................... 30. *V. stenophylla.*

KEY TO MASCARENE AND ARABIAN SPECIES.

Series II. Ovary covered with stiff hairs... 31. *V. pinifolia.*

Series III. Ovary rough, viscous, and glandular.

A. Glands sessile.
Margin bearing bristles. Leaves 5 cms. long, with tuft of white hairs in axil; margin and keel covered with small ascending bristles .... 32. *V. sessiliflora.*
Margin bearing numerous spines. Leaves 15 cms. long, densely pubescent ... 33. *V. spinulosa.*
Margin denticulate when old. Leaves 15 cms. long; when young ciliated with numerous pale brown bristles; pectinate .... 34. *V. pectinata.*
Margin thickened and toothed. Leaves 3 dms. long; very rigid and glabrous, midrib triquetrous beneath .... 35. *V dasylirioides.*

B. Glands capitate.
  Margin serrulate. Leaves 10 cms. long, with tuft of hairs in axil; keel distinct .... 36. *V. neglecta.*
  Margin scabrid or hairy. Leaves 2·5–7·5 cms. long .... 37. *V. arabica.*

Enumeration of Species.

1. V. HILDEBRANDTII Baker in Fl. Trop. Afr. vii. 409 (1898). *Barbacenia Hildebrandtii* Pax in Engl. Hochgebirgsfl. 171 (1892).

Somaliland: Serut Mountains near Maid, *Hildebrandt* 1466.

2. V. VILLOSA Baker in J. Bot. xxvii. 3–4 (1899); Fl. Cap. vi. 245 (1897).

Kalahari Region: Transvaal; Houtbosch, *Rehmann* 5792! Waterberg, *Rogers* 345!

3. **V. Monroi**, sp. nov.

Acaulescens, *foliis* congestis, rigidis, acuminatis, pubescentibus, *pedunculis* quam folia brevioribus, unifloris, rigidulis, gracilibus, pubescentibus; *floribus* inter majores; *perigonii segmentis* lanceolatis acutis, dorso pubescentibus, *antheris* linearibus, sessilibus, quam perigonii segmenta duplo minoribus; *ovario* turbineforme dense pubescente.

Leaves in tufts surrounded by the stiff dried bases of old leaves, 12 to 40 cms long and ·5 cm. broad, rigid linear, tapering to an acute apex, with distinct midrib, densely hairy on both surfaces, but less hairy when old; peduncles slender, 11–17 cms. long, densely pubescent; flowers large, mauve, solitary; segments 2·5–5 cms. long and ·5–1 cm. broad, lanceolate; stamens half as long as perianth-segments, with linear sessile anthers; ovary narrowly turbinate and tapering below, densely pubescent, 1·5 cms. long.

Type-locality: Rhodesia; Victoria.

Monro 2160! 800! Herb. Brit. Mus.

This species is closely allied to *V. villasa*, but the leaves are longer, less rigid, and less hairy, peduncles longer and more slender, perianth-segments naked except at the base.

4. V. VIOLACEA Baker in Bull. Herb. Boiss. ser. 2, iv. 1003 (1904).

Kalahari Region: Transvaal; Hanertsburg, *Junod*.

5. V. CLAVATA Baker in Fl. Cap. vi. 245 (1897). *Xerophyta clavata* Baker in J. Bot. xiii. 233 (1875). *Hypoxis vellosioides* Harv. ex Baker, *l. c.*

Natal: *Gerrard* 1824!

6. V. RETINERVIS Baker in Fl. Cap. vi. 244 (1897). *Xerophyta retinervis* Baker, *l. c.*; Gard. Chron. vi. 836, fig. 153 (1876); Regel in Gartenfl. xxvi. 161, t. 903 (1876). *Barbacenia retinervis* Marloth in Fl. S. Afr. 125–126, t. 38 (1915).

Kalahari Region: Transvaal; Megaliesberg, *Burks* 163! *Zeyher* 1672! Pretoria, *Bolus* 5802! *Rehmann* 4317! Barberton, *Galpin* 438! *Smith* 3055! Without locality, *Pearson*! *Lawrence*!

7. V. SCHNITZLEINIA Baker in Fl. Afr. vii. 409–10 (1898). *Schnitzleinia amica* Steud. ex Hochst. in Flora, i. 31 (1844).

Hypoxis Schnitzleinia Hochst. *l. c.* *Xerophyta Schnitzleinia* Baker, *tom. cit.* 235. *Barbacenia Schnitzleinia* Pax in Engl. Hochgebirgsfl. 171 (1892).

Abyssinia: near Sabra, *Schimper* 1365! near River Tacazza, *Schimper* 1693! without precise locality, *Schimper* 253! Arussi and Boran Countries and South Abyssinia, *Drake-Brookman* 127! 173! 174! 183! *Wellby*!

8. V. SOMALENSIS Chiov. in Annali Bot. ix. 141 (1911). *V. Schnitzleinia* var. *somalensis* Terrace, in Bull. Soc. Bot. Ital. 425 (1892); Baker in Fl. Trop. Afr. vii. 410 (1898).

Italian Somaliland: Gerar-Amaden, *Gandeo* and *Baudi.*

9. V. TRICHOPHYLLA Hemsl. in Bot. Mag. lx. t. 7962 (1904). *V. equisetoides* var. *trichophylla* Baker in Fl. Trop. Afr. vii. 411 (1898). *V. equisetoides* W. Watson in Gard. Chron. 1903, ii. 425, fig. 167.

Mozamb. Distr.: Nyasaland; Shire Highlands, *Buchanan* 162! Zomba, *Whyte* 92! *Johnson* 497! without locality, *Buchanan* 854!

10. V. EQUISETOIDES Baker in Fl. Cap. vi. 245 (1897), and in Fl. Trop. Afr. vii. 1898. *Xerophyta equisetoides* Baker in J. Bot. xiii. 233 (1875). *X. Melleri* Baker, *op. cit.* 234. *Barbacenia equisetoides* Fries in Bot. Untersuch. ii. 233 (1916).

Kalahari Region: *Elliot*! *Baines*!

Mozamb. Distr.: Nyasaland; Manganja Hills, *Meller*! Between Blantyre and Matope, *Woods*! Zomba and east end of Lake Shirwa, *Meller*! Zomba, *Purves* 29! Matabeleland, Semokwe River, *Baines*! Mashonaland, *Mrs. Cecil* 82!

11. V. WENTZELIANA, comb. nov. *Barbacenia Wentzeliana* Harms in Engl. Jahrb. xxx. 277 (1901); Fries, *l. c.*

Rhodesia: Unyorks, *Goetze* 1409! Salisbury, *Rand* 1451! Victoria, *Monro* 801! Matopo Hills, *Eyles* 25! Transvaal: Witbank, *Rand* 155!

12. V. Eylesii, sp. nov.

Planta pro genere parva; *caudice* superne furcato; *foliis* linearibus, marginibus pubescentibus, dorso plicatis et pubescentibus, inferne minus pubescentibus, *pedunculis* quam folia brevioribus, gracilibus et pubescentibus; *perigonii segmentis* lanceolatis, *antheris* linearibus, filamenta breve lata; *ovario* oblongo-cylindrico, dense hirsutis.

Shrub 15 to 30 cms. high, unbranched, with the leaves and flowers arising separately from the twin apices of the stem; leaves about 14 cms. long and 1 cm. broad, linear, with distinct midrib and softly hairy margin, inner surface very strongly veined and covered thickly with short fine hairs, outer surface similar but less hairy; peduncles slender, 12–13 cms. long, hairy; flowers pale purple and scentless; outer segments 4·5–5 cms. long and ·5 cm. broad, lanceolate; inner segments similar but slightly shorter; stamens with linear anthers 1·2–1·8 cms. long and broad, filaments ·2–·3 cms. long; ovary turbinate, verrieose, ·8 cm. long, with narrow linear style and columnar stigmas, of the same total length as the stamens.

Type-locality: Rhodesia; "Iron Mask Hill," Mazoe.

Eyles 440! *Clark*! Herb. Brit. Mus.

Closely allied to *V. suaveolens* and to *V. Wentzeliana*, from which it differs in the following points:—Leaves pubescent on both surfaces and margin, flowers intermediate in size between those of the other two species and ovary covered with long stiff hairs springing from shield-like bases.

13. **V. suaveolens**, sp. nov.

Frutex ramosus, 4–6 pedalis, *ramis* basibus foliorum vetustorum tectis; *foliis* rigidis, lineari-acuminatis, marginibus glabris, in facie superne pubescentibus, inferne glabris, *pedunculis* quam folia brevioribus, unifloris, rigidis, gracilibus, superne echinatis; *floribus* inter majores; *perigonii segmentis* lanceolatis, exterioribus dorso carinatis; *antheris* linearibus, sessilibus, quam perigonii segmenta plus duplo minoribus; *ovario* cylindrica dense echinato.

Shrub 12–18 dcms. high, 10–15 cms. in diameter at the base of the trunk, irregularly branched and clothed throughout with stiff fibrous leaf-bases, and giving off leaves and flowers from the same apex; leaves about 22 cms. long and ·5–·6 cms. broad, rigid, linear, tapering to an acute apex and having a distinct midrib and entire smooth margin, inner surface rough and hairy, outer surface very smooth, peduncles slender, stiff, 10–13 cms. long, the upper part covered with hair-like out-growths similar to those on the ovary; flowers appearing before leaves are fully developed, white or pale lavender, large and graceful, strongly scented, very numerous and often appearing on lateral branches, very attractive to bees; segments 5·5–6 cms. long, lanceolate, outer ones keeled but neither hairy nor glandular; stamens 2 cms. long, with long linear sessile anthers; ovary cylindrical and tapering at base, 1·2–1·6 cms. long, covered with stiff stellate hairs; ripening and splitting three weeks after flowering.

Type-locality: Rhodesia; Bernheim Hill, Mazoe.

Monro 2174! *Eyles* 439! Herb. Brit. Mus.

This species is closely allied to *V. Eylesii* and to *V. Wentzeliana*, from which it differs in the following points:—Leaves glabrous on the outer surface and margin, flowers larger and ovary covered with stellate hairs.

14. V. CAPILLARIS Baker in Fl. Trop. Afr. vii. 411 (1898). *Xerophyta capillaris* Welw. ex Baker in Trans. Linn. Soc., ser. 2 (Bot.), i. 264, t. 36. fig. 1 (1878); Durand & Schinz in Consp. Fl. Afr. v. 271 (1895); Rendle in Welw. Cat. ii 1, 35 (1899). *Barbacenia capillaris* Pax in Engl. Hochgebirgsfl. 171 (1892).

Lower Guinea; Angola; Huilla, *Welwitsch* 1558! *Gossweiler* 3830! *Pearson* 116!

15. V. HUMILIS Baker in J. Bot. xxvii. 4 (1889); Fl. Cap. vi. 246 (1897); Fl. Trop. Afr. vii. 409 (1898).

Kalahari Region: Transvaal; Bosch Veldt, *Rehmann* 5138! Apies River, *Burke* 122. Pilgrim's Rest, *Greenstock*! *Zeyher* 1671! Mozamb. Dist.: British Cent. Africa; Matabeleland, *Elliot*! Portuguese East Africa: Lower Zambesi, *Kirk*! British East Africa: Lake Rudolf to Gondokor, *Donaldson-Smith*! Rhodesia, *Eyles* 157! 517! 964! *Monro* 1881! *Rand* 226!

16. V. ROSEA Baker in Vierteljahr. Naturforsch. Zurich, xlix. 177 (1904).

Kalahari Region: Transvaal; Shiluvane, *Junod* 969

17. V. SCHLECHTERI Baker in Bull. Herb. Boiss. ser. 2, iv. 1003 (1904).

Kalahari Region: Transvaal; Donderhook, *Schlechter* 4136.

18. V. ACUMINATA Baker in Kew Bull. 228 (1895), Trop. Afr. vii. 410 (1898).

Somaliland: Golis Range; *Miss Cole* 317! *Mrs. Lort-Phillips.*

19. V. SCABRIDA Baker, *l. c.* *Barbacenia scabrida* Pax in Engl. Jahrb. xv. 144 (1892–3).

Lower Guinea: Angola, *Pogge* 123.

20. V. SQUARROSA Baker in Fl. Trop. Afr. vii. 410 (1898). *Xerophyta squarrosa* Welw. ex Baker in Trans. Linn. Soc. ser. 2 (Bot.) i. 264 (1878); Durand & Schinz, *op. cit.* 272; Rendle in Welw. Cat. ii. 36 (1899).

Lower Guinea: Angola; Pungo Androngo, *Welwitsch* 1555! *Welwitsch* 1006!

21. V. VISCOSA Baker in Fl. Cap. vi. 245 (1897). *Xerophyta viscosa* Baker in J. Bot. xiii. 235 (1875).

Kalahari Region: Transvaal; Zoutpansberg Div., Hout Bosch, *Rehmann* 5790! 5791! Lydenburg, *Rogers* 18257! Heidelberg, *Vandaleur*! Eastern Region: Griqualand East; Mount Currie, *MacOwan & Bolus*, Herb. Norm. 896! Natal; Drakenberg, *Wood* 3439! Van Reenen, *Wood* 9625! South-West Africa; Karasberg, *Pearson* 8455! *Deterlen* 218!

22. V. TOMENTOSA Baker Fl. Trop. Afr. vii. 412 (1898). *Barbacenia tomentosa* Pax in Engl. Jahrb. xv. 144 (1892–3); Harms in Engl. Pflanzenw. Ost-Afr. 146 (1895).

East Tropical Africa: Asi, *Fischer* 585!

23. V. VELUTINA Baker in Fl. Trop. Afr. vii. 412 (1898). *Xerophyta velutina* Welw. ex Baker in Trans. Linn. Soc. ser. 2 (Bot.) i. 265 (1878); Rendle in Welw. Cat. ii. 36 (1899). *Barbacenia velutina* Pax in Engl. Jahrb. xv. 145 (1892–3).

Lower Guinea: Angola; Pungo Andongo, *Welwitsch* 1556!

24. V. SPEKEI Baker in Trans. Linn. Soc. xxix. 156 (1875); Fl. Trop. Afr. vii. 412 (1898). *Xerophyta Spekei* Baker in J. Bot. xiii. 234 (1875). *Barbacenia Spekei* Harms, *l. c.*

Mozamb. Distr.: German East Africa; Uyanzi, *Speke & Grant* 782!

25. V. HEREROENSIS Baker in Flor. Trop. Afr. vii. 411 (1898). *Barbacenia hereroensis* Schinz in Bull. Herb. Boiss. ser. 1, iv. App. iii. 49 (1896).

Lower Guinea: Hereroland; Tebris Pass, *Fleck* 80!

26. V. KIRKII Hemsl. in Bot. Mag. t. 7692 (1904).

Mozamb. Distr.: Zomba, *Kirk*! Mount Ndurani, *Scott Elliot* 8524!

27. V. SPLENDENS Rendle in Trans. Linn. Soc. ser. 2 (Bot.) iv. 49, t. 8 (1894); Baker in Fl. Trop. Afr. vii. 412 (1898). *Barbacenia splendens* Harms, *l. c.*

Mozamb. Distr.: British Central Africa; Nyasaland, Milanji Plateau, *Whyte*! *McClounie*! *Mrs. Shinn* 191! Mount Malosa, *Whyte*!

28. V. ÆQUATORIALIS Rendle in Journ. Linn. Soc. xxx. 409

(1895); Baker in Fl. Trop. Afr. vii. 412 (1898); De Wildeman in Fl. Katang. ser. 4 (1902–3); Thonner in Blutenpfl. Afr. vi. 148 (1908); Durand in Syll. Flor. Congol. (1909). *Barbacenia æquatorialis* Harms, *l. c.* 145 (1895).

Mozamb. Dist.: East Africa; *Taylor*; *Kässner* 731! *Holst.* 2455! *Smith*! *Grenfell*!

29. V. ELEGANS Oliver in Bot. Mag. t. 5803 (1869); Baker in Fl. Cap. vi. 245–6 (1897). *V. Talboti* Balf. in Trans. Bot. Soc. Edin. ix. 190 (1867). *Talbotia elegans* Balf. *tom. cit.* 192. *Xerophyta elegans* Baker in Bot. xiii. 234 (1875). *Hypoxis barbacenioides* Harv. ex Baker, *l. c.*

Eastern Region: Natal, *Wood* 1114! 385! *Gerrard* 1555! *Sanderson* 598! *Rudatis* 379; *Cooper* 2563!

Var. *minor* Baker in Fl. Cap. vi. 246 (1897). *V. minuta* Baker in Bull. Herb. Boiss. ser. 2, iii. 667 (1903). *Xerophyta minuta* Baker in J. Bot. xiii. 231 (1875).

Natal, *Gueinzius*!

30. V. STENOPHYLLA Baker in Fl. Trop. Afr. vii. 410 (1898). *Xerophyta stenophylla* Welw. ex Baker in Trans. Linn. Soc. ser. 2 (Bot.) i. 265 (1878); Durand & Schinz, *op. cit.* 272; Rendle in Welw. Cat. ii. p. 1, 36 (1899).

Lower Guinea: Angola; Mossamedes, *Welwitsch* 1007! 1557!

31. V. PINIFOLIA Poisson, Récherch. Flor. Mérid. Madagascar, 98 (1912). *Xerophyta pinifolia* Lam. Encycl. ii. 392, t. 225 (1793); Willd. Sp. Pl. ii. 15 (1799); Pers. Syn. Pl. i. 346 (1805); Poir, Ency. viii. 804 (1808); Roem. & Sch. Syst. vii. 287 (1829); Baker in J. Bot. xiii. 235 (1875). *Xerophyta madagascariensis* Gmel. Syst. i. 530 (1796).

Madagascar: Central, *Commerson* 605–6 *a.* *Deans-Cowan*! *Scott Elliot* 3030!

32. V. SESSILIFLORA Poisson, *l. c.* *Xerophyta sessiliflora* Baker in J. Bot. xx. 271 (1882), and in Madagascar Plants, 99 (1912).

Madagascar: Betsileo, *Baron* 13!

33. V. SPINULOSA Poisson, *l. c.* *Xerophyta spinulosa* Ridl. in Journ. Linn. Soc. xx. 333 (1883).

Madagascar: Ankafana, *Deans-Cowan*!

34. V. PECTINATA Poisson, *l. c.* *Xerophyta pectinata* Baker in J. Bot. xx. 270 (1882), and in Madagascar Plants, 99 (1876–90).

Madagascar: Betsileo, *Baron* 15!

35. V. DASYLIRIOIDES Poisson, *l. c.* *Xerophyta dasylirioides* Baker in J. Bot. xiii. 234 (1875).

Madagascar; Central and South, *Baron* 642! 705! 974! 2106! 4126! 6948! *Scott Elliot* 1943! *Parker*! *Deans-Cowan*! *Hildebrandt* 3894! *Hilsenberg & Bojer.*

36. V. NEGLECTA Poisson, *l. c.* *Xerophyta neglecta* Roem. & Schult. Syst. vii. 289 (1829); Baker in J. Bot. xiii. 235 (1875).

Mauritius: *Commerson.*

37. V. ARABICA Baker in Kew Bull. 342 (1894). Hooker, Icon. Plant. 2364.

Arabia: Hadramant, *Lunt* 205!

THE FERTILISATION OF OPHRYS APIFERA.

By Colonel M. J. Godfery, F.L.S.

Even a cursory glance at the flowers of the Bee Orchis is enough to show that they are primarily designed for cross-pollination by insects. The bright-coloured sepals are well calculated to catch the eye, and the effect is heightened by the dark, strongly-contrasting lip. Self-fertilised flowers have no need of attractive colours, and natural selection could not evolve superfluous ornamentation of no use to the plant.

The whole construction of the flower in *O. apifera* is so clearly planned to secure cross-pollination by insects that it would be unintelligible on any other assumption. The intensive packing of the immense quantity of pollen-grains into two extremely small and portable pollinia—the attachment of each pollinium by its caudicle or stalk to a ball of very adhesive matter which sets hard like cement on exposure to the air—the immersion of this ball in a pouch full of moisture which preserves its viscidity till required for action—the swinging back on its hinge of the pouch when touched by an insect entering the flower, so that the viscid ball adheres to its head—the downward movement of the caudicles during the insect's flight, from a vertical to a horizontal position on a level with the stigma of the next flower visited—the bend or elbow in the caudicles tilting the pollinia upwards at the requisite angle to touch the inner roof of the chamber on which the stigma is situated— would all be meaningless if the pollinia are not required to be transferred from flower to flower. If *O. apifera* was originally designed to fertilise itself, they would be actually detrimental to this object, for they tend to remove the pollinia from the flowers which they might otherwise fertilise.

The mechanism of the flower in all other European species of *Ophrys* is identical with that of *O. apifera*, but all these species (I believe without exception) are entirely dependent on insects for pollination, for without their visits no seed-capsules are produced.

The mechanism of *O. apifera*, constructed on the same principle, can only be reasonably interpreted as intended to operate in a similar way.

It therefore comes as a shock to find that, whether in England, France, Switzerland, Italy, or Algeria, *O. apifera* is constantly self-fertilised. The pollinia emerge from the anther-cells, dangling on the long and flexible caudicles like a pair of cherries on their stalks, till they become poised in front of the stigma, and, oscillating with every breath of air, one or perhaps both swing against the stigma, and adhere. They swell in size, emit pollen-tubes, and fertilise the ovules in the same way as when brought by insects. It looks as if the caudicles had become too long and too flexible, but as their length and flexibility just suffice to bring them within touching distance of the stigma, a kind of short circuit has been set up, perhaps in the first instance by accident. Once this had happened it was likely to become increasingly frequent, for the offspring of self-fertilised plants (in which every flower sets a capsule) is bound to be more numerous than that of purely insect-pollinated individuals, of which every unvisited flower sets no capsule at all.

Darwin pointed out that even now, in *O. apifera*, the large viscid disc attaches itself to any object brushing against the rostellum, and that the pollinia can thus be removed, sometimes even after they have become attached to the stigma. Further, that the caudicles go through the usual movement of depression till they assume the exact position for touching the stigma of another flower (Fert. Orch. ed. 2, p. 56). In other words, the mechanism is still in working order—*O. apifera* has not lost the capability of being cross-pollinated by insects. That this actually does occur, even at the present day, is proved by the fact that undoubted hybrids have been found growing wild between *O. apifera* on the one hand and *O. arachnites*, *O. aranifera*, and *O. scolopax* respectively on the other. These hybrids could not possibly have arisen without the effectual visit of the same insect to each of the parents concerned. For one such visit to two different species of *Ophrys* in succession, there must be many more in which the insect confines itself to one species only, which is normally the case with bees.

Organs which are not used tend to become atrophied. Saprophytes like *Orobanche*, *Neottia*, and *Limodorum*, which derive nourishment from decaying organic matter instead of from the air, lose their leaves. Petals rendered superfluous by the conspicuousness of the anthers disappear, as in *Thalictrum* and in certain Australian myrtles. Stamens no longer needed vanish altogether, or leave only rudiments behind, as in *Ophrys*, which can now show only one stamen out of the original six. Nature will not waste nutriment and energy in maintaining functionless organs. That the mechanism of *O. apifera* remains to this day in efficient working order is sufficient proof that it has been all along in more or less active exercise of its functions. Darwin himself admitted that it is remarkable that none of the parts in question show any tendency to abortion (*l. c.* p. 58). Nor does *O. apifera* show any signs of deterioration in robustness of growth or brilliance of flower. At Vence its vigour is extraordinary—the plants often nearly 2 ft. tall, and the sepals of a particularly pleasing bright salmon-pink, which I have not seen elsewhere. Either it still enjoys a considerable measure of cross-pollination, or Darwin's theory of the great inferiority of self-fertilisation is much exaggerated.

M. Pouyanne has made the interesting discovery (Journ. Soc. nat. d'Hortic. de France, Feb., March, 1916) that *Ophrys speculum* in Algeria is fertilised by the males of *Colpa aurea*, which appear some time before the females (whose bodies are covered with long red hairs), and engage in ceaseless quest of the latter over ground where they lie buried in the pupa-state, pouncing eagerly on any individual which emerges. He tells me in a letter that if one takes a bunch of *O. speculum* in the hand to a colony of pupæ, the males at once alight on the flowers, and are so engrossed that they pay no attention to the observer. It is easy to see that they make no attempt to suck nectar, but mistake the lip of the flower for a female *Colpa*, which it resembles sufficiently to deceive the insect, owing to the fringe of long red hair and the blue metallic sheen of the centre, suggestive of reflections from closed wings. This seems to furnish a clue to the well-known resemblance of the lip to an insect in *O. apifera*, *O. muscifera*, etc. Darwin mentions that G. E. Smith says (Cat. Plants S. Kent, 1829, p. 25): "Mr. Price has frequently witnessed attacks made upon the Bee Orchis by a bee, similar to those of the troublesome *Apis muscorum*," and adds "what this sentence means I cannot conjecture." In the light of M. Pouyanne's discovery Mr. Price's observation becomes at least intelligible, and was probably correct.

Darwin much overstated the case when he said (Cross and Self Fert. p. 439) that *O. apifera* has "almost certainly been propagated in a state of nature for thousands of generations without having been once intercrossed." He was much nearer the truth when he wrote (Fert. Orch. ed. 2, p. 58): "from the structure of the flowers of *O. apifera* it seems almost certain that at some former period they were adapted for cross-fertilisation, but that failing to produce a sufficiency of seed they became slightly modified so as to fertilise themselves." He sums up by saying "The whole case is perplexing in an unparalleled degree, for we have in the same flower elaborate contrivances for directly opposed objects" (*l. c.* 57). It would be nearer the truth to say two different contrivances to secure the same object, *i. e.* the fertilisation of the flower, preferably by pollen from another flower, failing that, with its own. He does not appear to have realised the possibility of two concurrent methods of pollination in the same flower, and seems to have overlooked the fact that in other orders provision is made for self-fertilisation if cross-pollination fails to take place.

O. apifera presents a case of a flower organised for cross-pollination by insects, which has been endowed with or acquired the faculty of self-fertilisation, not in replacement of, but in addition to, its original capability of cross-pollination. It is not a case of reversion to a method of pollination in existence prior to adaptation for insect-visits, but of modification of the mechanism for insect-pollination itself, so as to ensure self-fertilisation if insects fail to visit the flowers. It is not retrogression, but a step in advance.

The maintenance in efficient working-order of the highly specialised mechanism proves that it has not fallen into universal disuse, and the occurrence of natural hybrids is an unanswerable refutation of the idea that the plant is now wholly self-fertilised. M. Pouyanne's discovery as to *O. speculum* makes it quite probable that the resemblance of the flowers of *Ophrys* to certain insects serves as a lure to attract the males of the species in question, and is not merely the offspring of popular imagination. It would be well worth while, for those who live where *O. apifera* is abundant, to endeavour to confirm or refute Mr. Price's observation.

HIERACIUM AURANTIACUM L.:

A CASE OF PROTECTIVE COLOURATION.

BY MILLER CHRISTY, F.L.S.

MR. PUGSLEY'S recent article on this plant (Journ. Bot. 1921, 60–69) has called to my mind certain observations I made many years ago in connection with it.

I spent the summer of 1882 in the Engadine, where a form of the plant grows in immense abundance in the meadows in the bottom of the valley, beside the River Inn, at an elevation of about 6000 feet. Everyone familiar with these meadows will be able to recall the amazing profusion of flowers of many kinds to be seen in them at the height of summer. Yet even more surprisingly abundant than the flowers is the almost inconceivable number of butterflies which frequents the same meadows at the same period of the year.

On the morning of the 14th July, which was exceptionally bright and hot, I saw, in the meadows at Sils Maria, butterflies in such extraordinary abundance that there seemed to be usually three or four, and never less than one, on every flower-head, whilst others were settled on the path and on the leaves of the grass. The greater number were Fritillaries, but various Blues, a Large Copper, Skippers, and others, were scarcely less abundant. As to the Fritillaries (of which there were certainly several species), they were so numerous that, from one large plant of *Phyteuma spicata*, the flowers of which were thickly covered with them, I took, with a single sweep of the net, no fewer than thirty-three individuals! I hesitate to make the statement, but the fact is definitely recorded in my diary under the date in question and I have still a very clear recollection of the incident.

The observation I wish to record is that the Fritillaries showed a very marked preference for the flowers of *Hieracium aurantiacum*. I noticed this particularly, because I was engaged at the time making systematic observations on the "constancy" of insects when visiting flowers (see Journ. Linn. Soc., Zool. xvii. pp. 186–194 (1884); also *Entomologist*, xvi. pp. 145–150, 177–181 (1883), and xvii. pp. 81–86 (1884)). The preference shown by the Fritillaries for the flowers of the *Hieracium* was too obvious to be overlooked. Many times I intentionally disturbed a Fritillary which had just alighted on a flower of this plant, and almost invariably, after a short flight, it alighted on another flower of the same species. This occurred regularly, even though I disturbed the same insect five, six, seven, or eight times. The preference was, indeed, beyond dispute. I had first noticed it, in meadows at Pontresina, on the 4th of the month, and again elsewhere on later days; but I never observed it to the same extent as on the date in question—which was due, doubtless, to the exceptionally hot weather on that day.

There can be no question, I think, that we have here a clear case of protective colouration; for the bright brownish-red or rich orange-brown of the flowers of the particular form of *Hieracium aurantiacum* in question agrees so closely with the general golden-brown colouration of the Fritillaries that the insect is largely invisible when at rest on a flower-head. A similar case is that of the common Orange-Tip butterfly (*Anthocharis cardamines*), which regularly alights on the flowers of the Earth-nut (*Bunium flexuosum*), the chervils (*Chærophyllum*), and allied plants, the colouration of the insect and these flowers being so closely similar as to render the insect difficult to perceive when at rest on a flower. Copper butterflies also frequented the flowers of the *Hieracium*, and their close similarity of colouring ensured for them equal protection when thus at rest; but, as they were less numerous, this was, in their case, less noticeable. These various butterflies are, of course, the insects by which the flowers of the plant are mainly pollinated (see Knuth, *Plant Pollination*, ii. p. 699; 1908).

As to the Fritillaries, their habit of frequenting the flowers of *Hieracium aurantiacum* has been recorded, no doubt, by some Continental observer; but in this country insect and flower are never found together in abundance, so that the habit has very likely passed unnoticed. Yet three weeks or so later than the date named (when the flowers of the *Hieracium* were largely over), I saw Fritillaries busy visiting quite a number of different species of flower.

PLANT NOMENCLATURE: MORE SUGGESTIONS.

I HAVE read with interest the suggestions in regard to plant nomenclature by Mr. Sprague (pp. 153–160), and agree with most of his proposed changes in the International Rules. There can be no doubt that the International Rules could be improved by changes in several of its articles, and if this would lead to a more or less close agreement between the followers of the International Rules and those of other codes, particularly of the Philadelphia or American Code, it would indeed be a goal worthy to work for and would be of great benefit to taxonomic botany.

In regard to suggestion No. 1 of Mr. Sprague, I am in perfect accord with him in his desire to revoke Article 36 and to make it a recommendation, as I have already proposed in an earlier article (Journ. Arnold Arb. i. 44–51 [1919]). I also agree with his suggestions Nos. 2, 4, 5, and 7, which are excellent, but with No. 3 we begin to tread on difficult ground, as it does not seem easy to decide where to stop in advocating changes of geographic names and what to consider extreme cases. The question may be raised whether a name like *Acacia sibirica* S. Moore in Journ. Linn. Soc. xxxiv. 189 (1899) should not be considered a misleading geographical specific name; the plant is not a native of Siberia but of Australia, and was named after a well called "Siberia Soak"; and this is unfortunately not the only case of such misleading names.

In suggestion No. 6 the rejection of all specific homonyms is recommended, which means a serious departure from the International Rules. To attain a "fixity of nomenclature" it seems sufficient to allow a name to stand if its earlier homonyms be really non-valid, that is, if it is a still-born name or nomen abortivum—which as a synonym I have called an unconditional synonym (*Rhodora*, xvii. 61, foot-note) or a nomenclatorial synonym (Journ. Arnold Arb. i. 45)—because in this case the earlier homonym cannot be revived. Thus *Quercus lanuginosa* Thuillier (1799) should stand, though there is an older *Q. lanuginosa* Lamarck (1778), which, however, is a still-born name and not valid, as it is only a new name for *Q. Cerris* L. (1753). I believe that, as I have tried to prove (*l. c.*), fixity of nomenclature can be attained within the present rules, if the term "valid name" is accepted in the sense of the revised Article 56, which reads in part: "By valid name is implied a name and especially a combination of names formed in accordance with the rules of nomenclature." The words in Article 50 "or because of the existence of an earlier homonym which is universally regarded as non-valid" should be changed to "or because of the existence of an earlier non-valid homonym." A name is either formed according to the rules and is valid, or it is not in accordance with the rules and thus non-valid. This, however, does not depend on universal or general consent, as consent implies voluntary action and the term general consent would mean the concurrent judgment of a majority of authors in regard to questions of taxonomic validity, while the application of accepted Rules of nomenclature does not depend any more on consent. For instance, *Picea canadensis* (Mill.) Britton, Sterns, and Poggenburg, should not be considered valid, as there is an older homonym, *P. canadensis* (L.) Link, which is, under the genus *Picea*, the valid name for *Tsuga canadensis* (L.) Carrière. As *Picea* and *Tsuga* are generally considered distinct genera, and thus *Picea canadensis* Link became by general consent a synonym of *Tsuga canadensis*, the name *P. canadensis* B. S. P. has been allowed to stand for the White Spruce; but if at any time botanists should merge the genus *Tsuga* in *Picea* then *Picea canadensis* Link would be revived and the name *P. canadensis* B. S. P. would have to be changed. On the other hand, a name like *Quercus lanuginosa* Lamarck, as stated above, is a still-born name and cannot become valid under any circumstances.

Suggestion No. 8 is an excellent one and would divest the "Nomina conservanda" of much of their alleged arbitrary character. A name should never be included in the list if its conception is so altered as not to include the type-species or even any of the original species, as is the case with *Alsine* L. (syn. *Minuartia*). A revision of the list of "Nomina conservanda" therefore seems desirable, as is a clear decision how cases such as *Wikstrœmia* Schrad. (see Blake in Contrib Gray Herb. liii. 36 and Sprague in Kew Bull. 1921, 175) or *Loiseleuria* (see Rehder in Jour. Arnold Arb. ii. 158) should be treated.

The suggestions No. 9 and 10 concerning orthography are well founded, but exception may be taken of No. 9 C dealing with indeclinable names borrowed from non-classical languages; for these it seems more practical to accept the gender as used by the author who introduced them as generic names. In regard to No. 11 one may say that it has been and is the general usage in all languages, as far as I know, to capitalize proper names, and that in names like *Liriodendron Tulipifera* and *Dracocephalum Ruyschiana* the specific name, if printed in lower case, would appear to be an adjective in the wrong gender.

Attention may be drawn here to Article 45 of the Rules relating to a question only slightly touched upon by Mr. Sprague by his reference to rules for fixing types recently incorporated on the American Code. This article takes no cognizance of the type method, which is more and more recognized as the most practical method in cases of division of groups, also by those who follow the International Code, as is shown by the additional recommendation XVIII *bis* incorporated in the Rules in 1910 by the Congress at Brussels: "When publishing names of new groups to indicate carefully the subdivision which is regarded as the type of the group: the typical genus in a family, the typical species in a genus, the typical variety or specimen in a species." Particularly objectionable, as not in accordance with the principle of priority, must be considered the last sentence of Article 45, which rules that in dividing a genus containing no section or subdivision which may be considered the type or origin of the group, the generic name is reserved for the part which contains a great many more species than the others. As this refers to the number of species at the time of the division and not of the founding of the genus, it may result, and in some cases does result, if the species added afterwards are more numerous than the original species, in the transfer to the new genus of most or all of the original species and even of the species which should be considered the type of the original genus; for instance, the genus *Azalea* contains in the general accepted sense neither of the two species, *Azalea procumbens* L. and *A. lapponica* L., upon which the genus originally was founded. The rule, moreover, leaves it uncertain how many more species a detached part should have, and opinion may differ as to what constitutes "a great many more species." In cases like *Erica*, where the retention of the generic name for the type-species would result in the transfer of a very large number of species, the name should be placed in the list of Nomina conservanda. In the genus *Erica* the type-species is certainly *Erica vulgaris* L., now generally called *Calluna vularis* Salisb., as indicated by its specific name; furthermore, it was the species best known to Linnæus, and the generic description as given by him applies primarily to this species, as is shown particularly by the words "Perianthium . . . . foliolis ovatis erectis, coloratis . . . . petalum quadrifidum . . . . capsula subrotunda, calyce minor, tecta." For the genus *Erica* in the conception of Salisbury *E. Tetralix* might be considered the type. If *Erica* is not placed among the Nomina conservanda and the type-method applied to the genus, one of the two genera separated by Necker from *Erica* would have to take the place of *Erica* L. sensu Salisb., which would make necessary about five hundred new combinations.

In regard to the nomenclature of hybrids a prevalent custom which does not seem to be sanctioned by the Rules is the addition of varietal names to a formula. According to the wording of Art. 34 and the example given, varietal names should be employed only if the hybrid has a binomial designation. It seems not only illogical to have a varietal name without a binomial designation, but also against the rules, as the names of hybrids are subject to the same rules as those of species and varieties according to Articles 31 and 34. Moreover, such names may cause confusion, as it would not be clear whether the varietal name belongs to the last species or to the formula as a whole, *e. g.* in names like *S. aurita* × *repens* β *argentifolia* Mayer and *S. caprea* × *daphnoides* var. *pulchra* Aschers. & Græbn., there is nothing to indicate that in the first case the varietal name belongs to the formula as a whole, while in the second case it indicates a variety of the *S. daphnoides*.

Regarding the nomenclature of varieties and other subdivisions of species, I may repeat what I have said two years ago in another place (Journ. Arnold Arb. i. 46–47):—

"Many botanists consider the different grades of subdivision of species as subject to the rules governing the change of rank, while others preserve the original author citation when changing a variety to a form or *vice versa*. One of the chief objections against the former practice is the lack of restriction placed on the number of subdivisions, for according to Art. 12 one is allowed to intercalate as many supplementary groups as one sees fit, and the absence in many cases of the exact designation of the nature of the different grades, which often are preceded only by letters, numeral or typographical signs, or are joined directly to the specific name (so-called trinomials). Even if such terms as variety or form are used they are frequently employed in a vague sense and may have different value in different publications. It is difficult to see how we can apply to subdivisions whose grade is not clearly defined the strict rules governing change of rank without introducing many unnecessary changes on account of different opinions on the valuation of certain names. The possibility also is thereby given to change at will almost any name of a subdivision by changing the designation of the grade, *e. g.* by calling a form a lusus, a subvariety a form, a variety a subspecies; though such changes are against the recommendations, they are not against the rules, and once made, whether intentionally or inadvertently, they cannot be revoked.

"To make the nomenclature of varieties as stable and simple as possible, it seems best to consider as groups of different ranks only those restricted to definite numbers, that is the main groups as enumerated in Article 10 and their subdivisions as given in Article 11, counting the subdivisions of each main group as one unit, that is as one rank, while the different kinds of subdivisions as admitted by Art. 12 which are of an indefinite number, may be considered grades or degrees of subdivision. Regarding the question whether the different subdivisions of species should be considered ranks, it seems significant that among the numerous examples illustrating change of rank, none is given which illustrates the change of any grade of subdivision of the same species. It also is to be noted that apparently subdivisions of a genus, as subgenus and section, are not considered as constituting different ranks, as shown by the first example under Art. 48: 'The subgenus *Alfredia* Less. of the genus *Rhaponticum* keeps its name when placed in the genus *Carduus*: *Carduus* sect. *Alfredia* Benth. & Hook. f.'

"I am therefore inclined to maintain in every case the oldest name regardless of change of grade of so-called rank. The name of the author, however, should be changed with a change in the grade, if the nature of the grade is clearly defined in both instances; if the original author failed to designate the grade the fixation of the grade is an emendation, and the name of the original author should be kept. If a combination is used as a so-called trinomial, the author of the original combination should be quoted regardless of any later change of grade.

"To designate a certain subdivision of a species, it is only necessary to add the name of this division to the binomial, omitting the names of any higher grades which may have been placed between this particular subdivision and the specific name. A combination of three names should always be sufficient to designate any group below the species. This, of course, does not apply to exact taxonomic work, where names and combinations should be cited exactly as published by their author."

To the last paragraph I should like to add that the practice of placing names of varieties or forms after the specific name without the name of any higher subdivision or subdivisions intercalated between the name of the species and that of the variety or form is implied by Art. 29, which rules that varieties under different subspecies or forms under different varieties of the same species cannot have the same name; this rule would be purposeless if the varietal name had to be used always in combination with that of its subspecies or the name of the form with that of its variety. This is also the opinion of Dr. Briquet, the editor of the International Rules, as stated by him in a letter to me of April 22, 1912. It should therefore be admissible to use, *e. g.*, the combination *Cratægus æstivalis luculenta* Sarg. or *C. æstivalis* f. *luculenta* instead of the published combination *C. æstivalis* var. *cerasoides* f. *luculenta*, and *Prunus glandulosa rosea* Koehne instead of *Prunus glandulosa* var. *glabra* f. *Sieboldiana* subf. *rosea*. The purpose of a name or combination of names is solely to enable us to designate clearly, and I may add as briefly as possible, any plant under consideration, and not give us its position in an elaborate systematic arrangement of the different variations of a polymorphous species. If we are forced to repeat the names of the subdivisions which may have been intercalated between the specific name and the form we are dealing with, the number of which is not limited by the Rules of nomenclature, we may as well go back to the long-winded phrases of pre-Linnæan nomenclature.

We might liken these cases to the publication of a new species in a large genus subdivided into subgenera; in the original publication of a species the name of the subgenus is often intercalated in parenthesis between the name of the genus and that of the species, but in the usage of the binomal the name of the subgenus is omitted, as the binomial is perfectly sufficient for the exact designation of the species.

The designation of all the forms of a polymorphous species by varietal names, to which the editor of this Journal seems to be opposed (see Journ. Bot. liii. 334) is apparently not against the International Rules, as Recom. XXVIII shows, where different methods of naming the typical variety are suggested. In many cases it may not be necessary to give a distinct name to the typical form, but in cases where the nomenclatorial type is different from the phylogenetic type or where it is not clear which form is the nomenclatorial type, it seems desirable to give a name to each of the subdivisions. *Viburnum macrocephalum* Fortune, for instance, was based on the cultivated form with all the flowers sterile, which therefore is the nomenclatorial type of the species; the spontaneous form with fertile flowers, the phylogenetic type, has been called var. *Keteleeri* Nichols., while the nomenclatorial form has been named var. *sterile* Dipp. If the name is used without the varietal name usually the spontaneous form is understood, but primarily the name should stand for the nomenclatorial type. In such cases where the type is uncertain, as *e. g.* in *Acer campestre* L., the different varieties should receive distinct names, as done by De Candolle, who distinguished *α. hebecarpum*, *β. collinum* (subspec. *leiocarpum* Pax), and *γ. austriacum*. This, of course, does not mean a trinomial system of nomenclature, as the trinomial is used only when a reference to a definite subdivision of a pleo- or polymorphic species is needed, but usually the binomial, even in regard to polymorphous species, will be sufficient. As regards the term "trinomial" I prefer to use it for any combination consisting of three names; there seems to be no reason to restrict it, as is often done, to combinations in which the varietal name follows the specific name directly without any letter, figure, typographical sign, or abbreviation of rank between them. As long as the rank is clearly stated in the original publication, there can be little objection to omit it when using the name afterwards. Also publications of new names in the following form "*Lobelia Hillebrandii monostachya* Rock, v. n. (in Mem. Bernice Pauhai Bishop Mus. vii. no. 2, 135, 1919)," cannot be considered as being contrary to the rules as long as the rank is stated, and even if the rank should only be implied they must be admitted as duly published.

In regard to some other question of nomenclature, I refer to my remarks in the *Journal of the Arnold Arboretum* (i. 44–45) already quoted.

Alfred Rehder.

Most British botanists will probably agree with Mr. Sprague (p. 153) that the "Rules" adopted at the Vienna Congress should be amended, and, although the prospect of another International Congress is remote, it seems desirable to begin to discuss the matter.

It is clear that Art. 36 cannot be allowed to stand. As pointed out, no one can reasonably ignore the name of a "group" adequately described in English. To my thinking, however, the principal objection to the rule is that the Latin language, admirable and fascinating as it is to the philologist, is neither sufficiently comprehensive nor precise for the purposes of modern scientific description and, in this respect compares unfavourably with the principal modern languages, with their greater flexibility and much richer vocabularies. In Roman times people did not know much about the Natural Sciences, and did not feel the necessity of defining form, texture, colour, etc., very accurately, nor of dealing at all with histological characters, which latter they had no means of investigating. It is true ingenious and scholarly folk do manage to construct elaborate descriptions in a language resembling Latin, but the same people could, no doubt, do much better in their native tongues. Instead of deleting Rule 36, perhaps it would be advisible to amend it by substituting, for the words "valid only when accompanied by a Latin diagnosis," the words "valid only when accompanied by a diagnosis in Latin or in one of the modern languages which employ Roman characters."

As regards suggestion No. 2 C, there can, I think, be little difference of opinion, for we must all recognise the absurdity of some of the names cited, which are certainly calculated to bring ridicule on the science.

As regards suggestion No. 11, I trust British botanists will never agree to the change advocated. I cannot conceive any argument which can justify a proper name being written with a small letter because it happens to be in the genitive case; and I am surprised that Mr. Sprague, who is evidently a classical scholar, should make the suggestion. It would surely be as reasonable to write "Mr. sprague's paper" as "*Luzula forsteri*."

As regards suggestion No. 12, the only one for which Mr. Sprague advances no reason, I should be sorry to see the comma between name and authority debarred by rule. In the theory of punctuation I take it the comma expresses the slight pause one makes, without dropping the voice, in order to separate a word or words from the context. In reading a name and authority, one would, I think, naturally make just such a pause between them, implying the omitted word "of" (or its equivalent); otherwise "*Bellis perennis* Linnæus" might be a gardener's trinominal. In the Paris "Laws," on which the Vienna "Rules" were based, the comma was used, and the fact that it was omitted in the "Rules" cannot, I think, reasonably be regarded as a pronouncement in favour of the omission by the Congress, representing more probably the individual views of the person or persons responsible for seeing the Rules through the press.

Looking backward at its effects, one seriously questions the wisdom of Art. 48, whereby the earliest specific name has to be reinstated when a species has been transferred to another genus, apart from the absurdities which Mr. Sprague has pointed out. In compliance with this rule, a very large number of generally-accepted names, the significance of which is quite clear, have already been superseded by much less clearly characterized ones, the correct application of which is by no means certain, thereby giving occasion for difference of opinion, and certainly not making for stability.

The *nomina conservanda* scheme, though it has its merits, is by no means free from objection, and obviously can only be carried out by general consent. The weight of the Vienna Congress has evidently not been sufficient to secure this.

I should like to make the suggestion that, in the case of fossil plants, the publication of the name of a "new group" should only be valid if accompanied by an illustration. A description alone is often inadequate for identification on account of the imperfect nature of much of the fossil material. The late Clement Reid, to whom I mentioned this suggestion, fully agreed with it.

Art. 58, which provides that the rules "can only be modified by competent persons at an International Congress convened for the express purpose" is delightfully litigious! Who is a "competent person," and what about the constitution of the Congress? Mr. Fernald's note, reprinted on p. 233, has done much to remove the impression that had got about, that the Vienna Congress was largely composed of Teutonic representatives, but perhaps for the future a little more information as regards the method of electing representatives and a list of the latter might give more weight to the decisions arrived at.

I cannot quite agree with Mr. Sprague that, because the Vienna Rules have been loyally complied with by many botanists, they necessarily meet with general approval. In the case of some, at any rate, in this country it has been due to the Englishman's propensity for "playing the game."

James Groves.

Mr. Sprague's advocacy of abandoning the requirement for a Latin diagnosis to constitute publication of new species and genera and the rejection of specific names when they are homonyms, irrespective of the validity of the earlier name, and when they differ from earlier names only in the adjective or genitive termination, as well as some of his suggestions relative to orthography and typography, are quite in the line of progress.

His recommendation that specific names identical with or merely variant from the generic name, or geographically misleading, should be rejected is not in line of progress toward nomenclatorial stability, though it has a certain literary value; while that calling for writing all specific names with a small initial letter has uniformity to commend it, but is destructive in a literary way.

Mr. Sprague's willingness to reject specific homonyms might lead him eventually to agree to rejecting generic homonyms as well, the principles involved being quite the same.

He refers incidentally to the rules for fixing generic and specific types advocated by many American students, and has thereby rendered nomenclatorial science a great aid, because these principles have not had much attention as yet outside of the United States, other than the citation of type-specimens of newly-described species in the recent writings of a few European authors; whereas this fixing of types really underlies the whole theory of a stable nomenclature, and its application under suitable restrictions would do away with the highly unscientific and arbitrary lists of generic names to be retained or rejected, independent of any nomenclatorial principles and full of inconsistencies, which now disgrace the International Rules. A large proportion of the names in these unfortunate lists are excluded or conserved respectively under the application of the type-theory.

In order to reach conclusions which might secure general acceptance, the fixing of generic types may well be referred to an International Commission by the next Botanical Congress. A very large number of generic names which are rejected in the present lists would also be rejected under the type-theory, because their types cannot be determined (hyponyms). On the other hand, there are no convincing reasons why such as are definitely typified should not be used.

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N. L. Britton.

THE EARLY HISTORY OF PLANTS.

The address delivered by Dr. D. H. Scott to the Botanical Section, of which he was president, of the British Association at its recent meeting was entitled "The Present Position of the Theory of Descent, in relation to the early History of Plants"; but his treatment of his subject was rather two able but distinct summaries—one of what he has termed "the return of pre-Darwinian chaos," the other of the origin of a land flora and the evidence of it afforded by Messrs. Kidston and Lang's work on the Devonian plants from Rhynie. While he truly remarks that "the theory of Descent or Evolution is undisputed," and even that the efficacy of Natural Selection in weeding out the unfit is still acknowledged and is even termed a truism, he says that "a new generation has grown up that knows not Darwin"; and that all ideas of evolution have been disturbed or transformed since the re-discovery of Mendel's work." Studiously fair in his statement, in admitting elementary species or Jordanons, "such as the countless forms of *Erophila verna*" to be "no less stable than Linnean species," Dr. Scott seems to fail in drawing any distinction between these two grades; but he seldom allows himself to more than hint a personal preference. When he speaks of the mutations of De Vries as suspected of being nothing more than Mendelian segregates, or in his sympathetic statement of Lotsy's theory of evolution by hybridisation, we recognise his open-mindedness. It is rightly pointed out that Darwin urged "the continual selection of the more fit, the preservation of favoured races, not the mere obvious elimination of the unfit," which last (first propounded by Spencer) was, perhaps, rather exaggerated by Wallace; but, whilst the conservatism natural to a veteran investigator suggests that "it may be that the theory of Natural Selection, as Darwin and Wallace understood it, may some day come into its own again," the next sentence admits "our present total ignorance of variation and doubt as to other means of change," so that "we can form no clear idea of the material on which Selection has had to work." Dr. Scott refuses "to venture on that well-worn subject the inheritance of acquired characters"; but in such phrases as "the whole tendency of modern work is to show that in living things Heredity is supreme," he does not evince much sympathy for neo-Lamarckians.

As a palæontologist, Dr. Scott declines to follow Bateson and Lotsy in the abandonment of all attempts at phylogenetic reconstruction. He has obviously been much impressed by Dr. Church's essay on "Thalassiophyta and the Sub-aerial Transmigration," and accepts the suggestion that the transmigrant races, the ancestry of the land-flora, may have been Green Algæ of a grade of organisation as high as that now exhibited by the highest of the Brown. The most important part of the address was, perhaps, the sketch of the remarkable results, not yet all published, obtained by Messrs. Kidston and Lang from beautifully-preserved fossil plants in the Lower Old Red Sandstone chert of Rhynie, and the discussion of their phylogenetic implications. These plants were only partly known to the late Prof. Arber when preparing his posthumously published *Devonian Floras* in which he styled them "Procormophyta'; and the somewhat widely-varying structure of the genera now known has very broad bearings on morphology as well as on phylogeny. They possess distinctly vascular stems with stomata, though rootless, and in most cases leafless. As, however, they were peat plants, some of their characters may be due to reduction; and, even without carrying back the original transmigration from sea to land, as Dr. Church does, to pre-Cambrian times, we must admit that the Old Red Sandstone is far too late for the survival (which Messrs. Kidston and Lang appear to maintain) of original transmigrants. The terminal sporangia in *Hornea* and *Rhynia* are clearly only altered ends of branches comparable to the stichidium of the Florideæ, which renders Goebel's view of the sporangium as an organ *sui generis* no longer tenable; and we seem to see branches of a thallus developing into fertile fronds, and flattened barren pinnules with laminæ as a later development. Dr. Scott frankly admits that his former view that the Gymnosperms were derived, through the Pteridosperms, from the Ferns, must be given up, and that it is safer to regard Seed Plants as a stock probably as ancient as any phylum of Pteridophyta.

Our knowledge of Pteridosperms has so far advanced since 1903–6 that eight families are now known, five of them from the Lower Carboniferous. While maintaining the combination of these in one phylum, Dr. Scott concluded his most suggestive address by contrasting the polyphyletic views of Arber (who traced back four lines of descent to Thallophytic Algæ, viz. Sphenopsida, Pteropsida, Lycopsida, and Psilotales), and still more of Dr. Church, who says that "all the main lines of what is now Land Flora must have been differentiated in the Benthic epoch of the sea (*i. e.* as algal lines)," with the monophyletic views of Messrs. Kidston and Lang, who see in *Asteroxylon* a generalised type linking Psilotales, Lycopodiales, and Filicales, and in *Rhynia* and *Hornia* a much simpler type suggesting "the convergence of Pteridophyta and Bryophyta backwards to an Algal stock."

The whole address demands a careful perusal by all students of genetics, morphology, or taxonomy.

G. S. B.

NOTES ON BRISTOL PLANTS.

By James W. White.

I hear from Mr. H. S. Thompson, who is engaged on an ecological and photographic survey of the extensive mud- and sand-flats between Burnham-on-Sea and Brean Down, North Somerset, where a large area of changing coast at the mouth of the Parrett has recently become more or less covered with vegetation, that far out on the mud seaward of Berrow there is much *Salicornia dolichostachya* Moss (determination confirmed by Dr. E. J. Salisbury), which has not hitherto been recorded for the county, though it is known in Devon (Cambr. Brit. Fl. 1912). Marshall, too, got it at Dawlish in 1915. *S. dolichostachya* is placed by Drs. Moss and Salisbury in the Cambr. Brit. Fl. as the sole representative of their *Dolichostachyæ*, and Mr. Thompson says the description there given fits the Berrow specimens excellently. He noticed some that consisted merely of a single long spike of 8–12 cm. on an unbranched stem of similar height. The seeds produced are quite large, up to 2 mm., covered with long hairs.

Although the mud-flat vegetation is entirely submerged at high tide, Mr. Thompson met with some *Glyceria maritima* in flower on July 9. The flowering had ceased by Aug. 23.

Another most interesting fact reported by my friend is that *Spartina Townsendi* has become well established on the Berrow flats, two of the three clumps observed being about three yards in extent. The probability is that these originated from detached roots washed down Channel *viâ* Sand Point and Brean Down from the foreshore below Clevedon, 15 miles N.N.E., where *Spartina* was planted about the year 1913 (see Journ. Bot. 1918, p. 84).

On August 27 *Limosella aquatica* L. was discovered by Messrs. H. J. Gibbons and C. Alden on the mud of a dried-up duck-pond some five miles N.E. of Bristol. The plant grows in fair quantity amid a litter of sherds, old tin cans and kettles, and the feathers of poultry, while the drainage of neighbouring cottages finds its way along the margin. A spot less attractive to rambling botanists can hardly be imagined, so there may be some excuse for those of the last generation who passed by the place unheedingly year after year. Save for a locality in the Forest of Dean, this appears to be the first authentic record for West Gloucester; and the species is new to the Bristol district.

The dry summer has favoured *Cyperus fuscus* in the Walton valley. This is a plant that thrives and blossoms in perfection only when the season is precisely to its liking: in other years it remains dormant and makes no sign. Moisture it must have, of course, but not too much. As a result of the late drought water in the broad peat ditches had become reduced to a depth of about two inches, and in this at the middle of August the sedge appeared in such profusion that a dozen tufts could be taken from a square yard of ditch bottom. This display, however, was speedily ended, for with the first rains, a fortnight later, the water rose and submerged it all. And before winter sets in these ditches will have been trimmed and raked out by the farmers' men.

SHORT NOTES.

Collecting Aquatic Plants (p. 260). Mr. Pearsall's practical directions for collecting and preserving linear-leaved aquatics will be welcomed by those whose botany has an æsthetic side, and who do not regard herbarium specimens merely as laboratory material, but wish them to be, as far as possible, at least reminiscent of the beauties of the growing plants. I would advocate the extension of the treatment to all our water-plants, with the exception perhaps of water-lilies, but even the submersed leaves of these latter will be the better for being "floated out." One group especially occurs to me in this connexion, the Callitriches. A greater contrast can hardly exist than that between the miserable little tangle of draggled stems, with some slips of paper across, which often does duty for a "specimen," and a real specimen of one of these beautiful plants which has been carefully floated out. I need perhaps hardly mention that Callitriches should be put out soon after collection, or, if this is impossible, put into a bowl of water, otherwise the rosettes will grow out and lose their distinctive characters, besides spoiling their appearance. My experience has been that even the very delicate water-plants will carry well, and even keep for days in the vasculum, if well washed and placed in thin layers between two or three thicknesses of newspaper and rolled up tightly. The addition of some clean stiff water-plant, *Elodea* best of all, is very helpful with the more delicate things. Mr. Pearsall's zinc trays must be excellent for floating out, but if such are not available, large photographic trays answer well. I have found a sheet of perforated zinc under the paper a great help in getting the specimens out of water without disarrangement, and a moistened camel-hair brush useful immediately afterwards for putting stems and leaves straight before the water is drained off. I have found calico more satisfactory than blotting-paper to lay over the specimens, and would advocate the first change of the drying-paper, removing the calico (except in the case of sea-weeds) the day after putting them in, and a second change in two or three days. Mr. Pearsall's hints come most opportunely just now, when Mrs. Arber's delightful and entirely admirable book *Water Plants* must have given a great stimulus to the collection of aquatics. May I express the hope that others who find out successful methods for dealing with difficult specimens might similarly help by communicating them to the Journal? For instance, I think most of us would welcome directions for satisfactorily drying succulent plants.—James Groves.

[We gladly endorse Mr. Groves's suggestion.—Ed. Journ. Bot.]

Fertilization of Mistletoe (see Journ Bot. 1918, 331). Further experiments to prove the method whereby *Viscum album* effects its pollination have been made this spring. All the flowers of the male plant, which grows on the same tree as the female plant on which all the experiments have been made, were carefully cut out as soon as they were formed. Pollination from this source was absolutely impossible. Another male plant, which is the only one existing within a radius of several miles, is growing on a tree sixteen feet distant from the aforesaid female plant, in a due north line. Both these plants are about the same height from the ground on their respective hosts. No other bar, beyond that of the sixteen feet of distance, was put to prevent pollination. The result has been that the female plant has set less than half its usual quantity of berries, or, it may be, not much more than a third. Excellent weather, with plenty of sun, lasted all the time the plants were in flower, and as the wind was always S.W. it is difficult to see how the pollen could have been carried by its means. The only insects seen on the flowers were one or two minute midges.—ETHELBERT HORNE.

LATHRÆA SQUAMARIA L. PARASITIC ON YEW. A few months ago I received from the Duke of Wellington some specimens of *Lathræa*, from Ewhurst, in the north of Hampshire, apparently parasitically attached to the roots of yew. The species is recorded as "under yew-trees" from the same neighbourhood (Townsend, *Flora of Hampshire*, ed. 2, p. 289); and, as it is also stated to grow on beech, hornbeam, poplar, whitethorn, and (*teste* Bell's *Selborne*, ii. 241) on plum, as well as the more frequent elm and hazel, it would seem not to be particular as to its host plant. This new record, however, has another interest in that the Duke, corroborated by a clergyman of the neighbourhood, speaks of the plant as familiarly known for many years in Wiltshire as "cuckoo-flower"—a name which is not recorded for this species in Britten and Holland's *Dictionary of English Plant Names*, although doubly appropriate, from its season of flowering and from its parasitic habit.—G. S. BOULGER.

CAREX PULICARIS forma MONTANA (see pp. 106, 146). On the 6th September last I noticed this sedge in good fruit in several spots in Cwm Idwal, Carnarvonshire, and its perigynia were in no cases regularly deflexed, as in the specific type, although the bracts were mostly fallen. The fruits, which appeared darker in colour than in the lowland form, were sometimes suberect, sometimes deflexed, and often patent-divaricate. While the plant was of dwarf growth in relatively dry situations, on very wet rocks it sometimes became elongate and as tall as the type. A few days later I again met with this sedge in abundance and showing the same fruiting characters on the wet rocks of Foel Fras (alt. 2500 ft.).—H. W. PUGSLEY.

BOOK-NOTES, NEWS, ETC.

THE *Kew Bulletin* (No. 5, August) contains a paper on the *Winteraceæ*, by Mr. J. Hutchinson, which includes "a Key to the families more closely related to Magnoliaceæ; the group may take ordinal rank as *Magnoliales*." Mr. Hutchinson also contributes an account of *Therorhodion*—a genus established by J. K. Small for the section of *Rhododendron* so named by Maximowicz—of which three species are described. Mr. John Parkinson gives a full account of

Eucommia ulmoides, "the Tu-chung of the Chinese" in "Notes on *Raimannia* and allied Genera." Messrs. T. A. Sprague and L. A. M. Riley give the characters by which *Raimannia* and *Anogra* are separated from *Œnothera*, with various new combinations resulting therefrom. Mr. Sprague also revises the genus *Capraria*; we note that *C. cuneata* is attributed to Robert Brown, although, as is stated in this Journal (1907, 315), his name is in no way connected with it in Ait. Hort. Kew (ed. 2, iv. 47), where the species is published. Mr. J. Burtt Davy writes on new and noteworthy South African plants; and Mr. Boodle on Mistletoe on the lime-trees at Hampton Court. No. 6 contains an illustrated account of Captain Hill's "Visit to the Cameroons and Nigeria" in February and March last, with a list of the plants collected by him in Northern Nigeria drawn up by Mr. Hutchinson, who describes several new species.

THE *Annals of Botany* (July) contains continuations of Lady Isabel Brown's researches on the Anatomy of *Equisetum* and of C. Boyle's "Studies in the Physiology of Parasitism"; E. M. Cutting writes on "Variations in the Flowers of *Stachys sylvatica*." Other papers are "On certain Plastids, with special reference to the Protein Bodies of *Zea*, *Ricinus*, and *Conopholis*," by D. M. Mottier"; "Cytological Study of Pollen Development in *Lactuca*," by R. Ruggles Gates and E. M. Rees; "Cytology of *Tilletia Tritici*, by J. F. Dastur: Mr. E. J. Chandler has a note on the "Occurrence of *Sequoia* in the Headon Beds of Hordwell, Hants."

Nos. 1 and 2 of *Annales Mycologici* for 1921 (Berlin, Friedlaender) contain "Einige Bemerkungen zu den *Astragalus* und *Cytisus* benohnen den *Uromyces* Arten," by F. Kobel; "Mykologische Notizen," containing descriptions of many new genera and species, by F. Petrak; "Polypores new to Bengal" (*Fomes rufolaccatus*, sp. n., with plate), by S. R. Bose; an enumeration of Sydow's "Mycotheca Germanica" (nos. 1401–1800) with descriptions of novelties; and a comprehensive list of "Neue Literatur."

FROM the *Transactions of the London Natural History Society* for 1920, we learn that during that year 6 species were added to the botanical records of the northern portion of the district embraced by the Society, and 91 (of which a list is given) to those of the southern portion; the larger number is due to the fact that it represents only six years of work, while the northern portion has been under observation for fifteen years.

THE following appreciative notice—headed "Plant Portraits at Kew—300 Years of Progress"—appeared in the *Times* for August 26th:—"In a small room opening out of the [Marianne North] Gallery, a collection of water-colour drawings of individual plants has recently been arranged. The nucleus of this collection was a series by different artists got together by the late Sir Arthur Church, who, though best known as a chemist, was an enthusiastic collector of works of art and himself a painter of no small skill, and passed the last years of his life at Kew. This series, presented by his widow, has been wisely supplemented by specimen drawings previously belonging to the Gardens, so as to make up a consecutive representation of the progress of plant portraiture from Simon Varelst (1604–1651) to the present day. A brief account of the paintings and of the artists has been printed and is in the room. From it we learn that Varelst, a native of Antwerp, essayed the portrayal of human beings, but failed signally. It would, however, be difficult to surpass the beauty and accuracy of his blue *Gentiana acaulis* in this series. Most of the artists here represented are known only for flower-painting, although Thomas Stothard is a noteworthy exception. It is interesting to see the high degree of artistic merit achieved by men who began with a botanical knowledge of their subjects, whether gardeners at Kew, such as George Bond and Thomas Duncanson, or botanists such as Sir William Hooker and Sir Joseph Hooker. The superb work of Redoutté [*sic*], who has been termed the Raphael of flowers, and of Ehret, who drew for Linnæus and for Sloane, is no doubt better represented elsewhere; but it would be difficult to excel the accuracy of John Traherne Moggridge's Riviera orchids or the graceful charm of Marie [Maria Sibilla] Merian's polyanthuses. Nothing in the collection surpasses, in our opinion, the three little drawings of our British butterworts painted by Susan Lecky in 1860."

The *Transactions of the British Mycological Society* for 1920 (published 15 July) contains an account of the Minehead Foray by Mr. John Ramsbottom, who also contributes a note on the organism known as "Californian Bees": the Mycetozoa and Lichens of the Minehead district are dealt with by Miss Lister and Mr. H. H. Knight respectively: a new genus—*Cytotriplospora*—of "Fungi Imperfecti," based on specimens on fir trees from Oxshott Woods, Surrey, is described by Dr. Bayliss Elliott and Helena C. Chance: other new or interesting species are described by Dr. Malcolm Wilson and Messrs. Carleton Rea, A. A. Pearson, and H. Bourdot. Mr. Paulson writes on "The Sporulation of Gonidia in the Thallus of *Evernia prunastri* (with plates); Mr. T. Whitehead "On the Life History and Morphology of *Urocystis Cepulæ*," also with plate; Mr. T. Petch has a long paper on "Fungi parasitic on Scale Insects" camouflaged under the title "Presidential Address," and the first portion of "Studies in Entomogenous Fungi." Mr. Reginald Buller, of the University of Manitoba, contributes a short but remarkable paper "Upon the Ocellus Function of the Subsporangial Swelling of *Pilobolus*" which formed the subject of an address delivered at the Linnean Society on June 16 to which reference is made on p. 206 of our July number.

The *Observer* for some weeks published notes on the occurrence of the Lizard Orchis in Kent, which is evidently more frequent than is usually supposed. In the issue for August 21, Mr. A. D. Webster states that it "grows wild in some quantity in private grounds not far from Dover," and Mr. C. B. Tabourdin writes from 86 Manor Road, Wallington: "There is no doubt of the existence of the Lizard Orchid in East Kent during this and recent years. Three specimens from that district have been sent to me this year, and I have heard of others. It may interest your readers to know that it has occurred in recent years in southern Sussex from east to west. I have also heard of a specimen in Essex during the last few years. I will only add that I am satisfied that my information is from really reliable sources."

THE *New Phytologist* (Aug. 19) contains a continuation of Mr. Walter Stiles's essay on "Permeability"; Mr. W. H. Blackman writes on "Osmotic Pressure, Root Pressure, and Exudation"; Mr. J. Lynn on "The Reversal of Geotropic Response in the Stem" (with plate). The number issued on Aug. 19 contains a continuation of Mr. Stiles's paper, with papers on "Osmotic Pressure, Root Pressure, and Exudation," by V. H. Blackman, and on "The Reversal of Geotropic Response in the Stem," by M. J. Lynn, D.Sc.

The Journal of the Linnean Society (Botany, vol. xlv. no. 303; Sept. 6) is chiefly occupied by the first part (Angiosperms) of "A Systematic Account of the Plants collected in New Caledonia and the Isle of Pines by Prof. R. H. Compton in 1914." The plants are in the National Herbarium, and have been worked out by its officers—the Monocotyledons by Dr. Rendle, the Polypetalæ by Mr. Baker, the Monopetalæ and Apetalæ by Mr. Spencer Moore. Eight hundred and thirty species are enumerated, two hundred and thirty of which are new. Among them are ten new genera—these are *Comptonella* (Rutaceæ), *Salaciopsis* (Celastrineæ), *Montagueia* (Anacardiaceæ), *Paracryphia* (Eucryphiaceæ), *Enochoria* (Araliaceæ), *Merismostigma* (Rubiaceæ), *Tropalanthe* (Sapotaceæ), *Depanthus* (Gesneraceæ), *Adenodaphne* (Lauraceæ), and *Dendrophyllanthus* (Euphorbiaceæ). The paper is illustrated by twelve plates, in which the more interesting plants are figured. The number also contains a revision of *Baphia*, by Mr. Lester-Garland, enumerating fifty-eight species, three of which are new; and a short "Contribution to the Teratology of *Datura*," by Prof. J. B. de Toni.

Records of the Botanical Survey of India (vol. vi. no. 9; March) is devoted to an enumeration, with notes and local names, of the "Useful Plants in the District of Lakhimpur in Assam," by Dr. and Mrs. Humphrey G. Carter, based on specimens and information collected in 1915.

THE Correspondence of Ludwig David von Schweinitz (1780–1834) and John Torrey (1796–1873), edited by C. L. Shear and Neil E. Stevens, has been issued (July 16) as part 3 of vol. xvi. of the *Memoirs* of the Torrey Botanical Club. The letters extend over a period from December 1819, when Torrey began the correspondence, until November 1833—the date of the last letter to Schweinitz, who died in the following February,—and, it is needless to add, are full of interesting matter, as the two botanists were, as the editors say, "the two dominating figures in American botany during the early part of the nineteenth century." Portraits of each are given, and brief but useful biographical notices of the persons mentioned in the correspondence are supplied in an appendix.

Wanted.—Moss's 'Vegetation of Somerset' (1907); Thompson's 'Liste des Phanérogames,' etc. (Le Mans, 1908); 'Journal of Botany' (1868–81).—H. S. THOMPSON, 5 Westbourne Place, Clifton.

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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ORCHIS ELODES Grisebach.

By Colonel M. J. Godfery, F.L.S.

Dr. Stephenson, in his most interesting paper on the forms of *Orchis maculata* (J. B. 1921, p. 126) rather overstated the case when he said that I insisted that *O. ericetorum* Linton is not found on the Continent. What I intended to convey was that we could not assume that it grows there without positive evidence to that effect. None of the varieties of *O. maculata* mentioned by French and German authors agree with *O. ericetorum*, with the possible exception of *elodes*, but even in this case their descriptions are not sufficient to justify positive identification. I felt, therefore, in the absence of Grisebach's original diagnosis, that it was an open question whether *ericetorum* occurred on the Continent.

On May 14th of this year, on Mont Mirat, Falaise, Normandy, on high gorse-covered ground, growing amidst typical flowering *O. morio*, I found in early flower what I took to be *ericetorum*. Dr. Stephenson, to whom I sent specimens, said they could not be separated from the British form. Dr. Druce tells me he has since found *ericetorum* in Belgium. There can be no doubt therefore of its occurrence on the Continent. I have now seen, in the excellent library of the Department of Botany, A. Grisebach's original description of *O. elodes*, in *Ueber die Bildung des Torfs in den Emsmooren*, 1846, p. 25 (reprinted from *Göttingen Studien*, 1845), which, as it appears to be little known, I give here:—

"*Orchis elodes* nov. sp. tuberibus geminis palmatifidis, foliis (4–5) lanceolatis acuminatis sursum decrescentibus, bracteis nervosis ovarium superantibus, floribus incarnatis pictis, perigonii segmentis semilanceolatis, exterioribus patentibus, labello trilobo, calcare descendente filiformi acuminato ovarium dimidium æquante. Calcar basi $\frac{1}{2}'''$ diam., tenuissimum, versus apicem obtusiusculum attenuatum, rectum, pendens. Perigonii foliola exteriora interioribus conformia et ejusdem longitudinis. Labellum longitudine latitudinem æquante, lobo medio exterioribus paullo breviori. Statura spithamea *O. latifoliæ.*—Dignoscitur ab *O. maculata* L., quacum calcare attenuato, caule solido foliisque supremis a spicâ remotiusculis decrescentibus convenit: (1) foliis inferioribus lanceolatis (neque oblongis), omnibusque patentibus; (2) numero foliorum plus duplo minori; (3) bracteis omnibus ovarium superantibus (neque mediis ovarium subæquantibus); (4) perigonii segmentis angustioribus; (5) calcare multo tenuiori filiformi; medio linea dimidia angustiora; (6) præcipue vero brevitate calcaris ovarium dimidium æquantis (nec superantis).—Habitat in ericetis turfosis totius paludis Bourtangensis sparsim. Fl. m. Majo et Junio (*O. maculata* multo præcocius)."

The above unusually full diagnosis fits our British *ericetorum* like a glove; if anyone doubts this let him ask himself in what respects the latter differs from *elodes*. It not only embodies all the main characters assigned by E. F. Linton (Fl. Bournemouth, p. 208, 1900), but actually gives two easily verifiable peculiarities not mentioned by the latter—the narrower sepals as compared with *maculata*, and the fact that they are spreading, *i. e.* neither erect nor reflexed. It gives no character not found in *ericetorum*, and agrees exactly as to habitat and early period of flowering. It is true that it does not specifically mention the narrowness of the mid-lobe of the lip, but "labellum longitudine latitudinem æquante" is a fair equivalent of Linton's "lip sub-orbicular," and implies the greater breadth of the side-lobes. No doubt Grisebach laid too much stress on the brevity of the spur, which according to Dr. Stephenson varies from 4–10 mm., but some British specimens gathered by me had the spur much shorter than the ovary. On the whole, a more faithful description of *ericetorum* could hardly be given than Grisebach's diagnosis of *elodes*, and, had it been known and accessible, there can be little doubt that *ericetorum* would have been assigned to it in the first instance. Published in 1845, it is long prior to Linton's *O. ericetorum*, and even to Webster's *O. maculata* var. *præcox* (1886); and our plant should therefore in future be known as *Orchis elodes* Griseb. or *O. maculata* var. *elodes*, according to the view held as to its specific or varietal status.

The question whether *elodes* is a distinct species or a mere variety of *maculata* depends partly on the degree of systematic accuracy desired. Linnæus was convinced that all forms of the modern genus *Ophrys* were varieties of one species, *O. insectifera* L.; Reichenbach f. recognised that *Ophrys* contained several species, but was content to accept Crantz's composite species *Epipactis helleborine*, embracing *latifolia*, *rubiginosa*, *violacea*, and *microphylla*, which would hardly satisfy a modern student of the genus. When the generic characters are strong and obvious, as in *Ophrys* and *Epipactis*, and the specific ones relatively much less marked, there is a tendency to undervalue the latter and regard them as merely varietal. There was every excuse for Linnæus's view of *Ophrys*, for he believed that every species was a separate creation; and as he clearly saw that all forms of *Ophrys* must have sprung from one common origin, he had no choice but to regard them as belonging to the same species. The case is different now that it is recognised that species have been evolved from a common ancestor. The difference between a species and a variety is mainly one of *time*. If the common ancestor is distant, and especially if it is now extinct, two plants may justly be considered as specifically distinct, but if the variation is only in minor points from a still existing species, the one can only be regarded as a variety of the other. If the differences between *maculata* and *elodes* are sufficient to justify the belief that they sprang from a distant common ancestor, and that no plant now exists which could have given rise to both, they would both appear to be equally entitled to specific rank.

It cannot be denied that there is a strong family likeness between *maculata* and *elodes*. No Continental botanist previous to Grisebach (1845) appears to have noticed the latter plant, and no British writer till 1886, when Webster proposed it as a new species (*O. præcox*) before the Botanical Society of Edinburgh, and it was promptly turned down as a variety of *maculata*. Nevertheless, there is hardly any part of the plant which does not show some difference from the corresponding one in *maculata*, though it may be argued that these are more differences of degree than of kind, and lie within the range of possible variation. Though individually not of decisive importance, they are co-ordinated to form a whole which is remarkably constant. They are not found with varying changes and permutations, but are closely correlated. Each item may be small, but the sum total is considerable. I am inclined to think, however, that no *conclusive* argument, either for or against specific identity, can be drawn from a comparison of the two plants.

The evidence furnished by their distribution in Britain does not appear to have been sufficiently considered. *Maculata* grows on stiff basic soils in woods, fields, etc., and on chalk downs, attains its greatest perfection in a cool rich loam, and is mainly a lowland plant. *Elodes* grows on heath-land, on the peat, frequently in boggy ground amongst sphagnum. Webster found colonies of it killed outright through drainage. Dr. Stephenson tells me that *elodes* is very plentiful in the island of Arran from sea-level up to highland bogs, but *maculata* is confined to the lower levels. Each species occupies large areas in Britain from which the other is entirely absent, showing that the habitat of the one is unsuitable to the other. In a few limited areas they are found together, but this is rare, and is probably due to the soil-conditions necessary for each overlapping in these very restricted localities. Under such conditions hybrids occur, but Dr. Stephenson says that in Arran, where they grew together in places, they very seldom seemed to cross. Ascherson and Graebner state (Syn. iii. 748) that *elodes* is very difficult to grow, easily dying off, and resenting any change of environment or conditions of growth, but, nevertheless, shows great constancy under cultivation.

If *maculata* and *elodes* grew freely together over large areas, it might be argued that the differences between them are not so great that they cannot be explained by variation; but, since each occupies large areas from which the other is absent, it is evident that there is some inherent difference of a deeper kind. If *elodes* is a mere variety of *maculata*, why does it not arise in the areas where *maculata* is abundant? A variety must necessarily arise in the neighbourhood of the mother-species, and fairness compels us to admit that the soil which is favourable to the parent-plant should be equally so to its varietal offspring. It seems improbable that a plant should give rise to a variety which cannot exist on its parent soil, and the complete absence of *elodes* from large areas where *maculata* is prevalent shows that it cannot establish itself under the conditions favourable to the latter.

If it be suggested that seeds of *maculata* were blown on to heath-land, grew there, and became gradually modified into *elodes*, this easy solution involves many difficulties. *Maculata* cannot grow on heath-land, or at least cannot maintain itself there, for how else can the complete absence of our commonest and most prolific orchid from the areas occupied by *elodes* be explained? The first seeds germinating in the new habitat would be pure *maculata* (for a certain time *must* be necessary for the new environment to take effect) and would have a hard struggle against adverse conditions, which they must overcome successfully, not only in considerable numbers but for very long periods to produce *elodes*. We might fairly ask, if *elodes* sprang from *maculata* in the past, why do we not find forms of *maculata* at the present time on heath-land in various stages of transition? In any case a long period would be required for *maculata* to be transformed into *elodes*, and a still longer one for the whole constitution of the plant to be so completely changed that it cannot exist on the parent-soil from which it sprang. We are thus driven to the conclusion that the ancestor from which it was derived was a distant one. It has been observed that the most nearly allied species occupy different areas. The natural explanation appears to be that they are descended from a remote ancestor which occupied both areas, whose descendants in each area became gradually differentiated till they diverged into two distinct species. It seems more probable that both *maculata* and *elodes* have sprung from a distant common ancestor equally at home on peat or chalk or basic soils, and have been modified by gradual adjustment to their respective environments, than that *maculata* itself has remained unchanged in form and habitat, but has given rise to a variety which can only flourish on an alien geological formation.

To say that *elodes* is only a "soil form" of *maculata* is to beg the question. Even assuming that the differences between them are entirely due to the influence of the soil, this influence must have been exerted for a very long period to produce the considerable morphological differences between them, and this points to a very ancient divergence. If both are "soil forms," seeds of *maculata* sown on peat should vary in the direction of *elodes*, and those of *elodes* sown on chalk etc. in that of *maculata*. But though millions of seeds of each species must annually fall on areas occupied by the other, each still remains constant to its own habitat, and in the few localities where they happen to grow together, each species maintains its own characteristics.

PLANT DERMATITIS.

By T. A. Sprague, B.Sc., F.L.S.

Dermatitis is known to be caused by numerous *Anacardiaceæ* not included in Miss E. P. Smith's list (Journ. Bot. 1920, 175). Feuillée, who visited South America in 1702–12, related that some of the seamen of his ship suffered severely as the result of cutting down some "Llithi" trees (*Lithræa caustica*) on the coast of Chile. By the following day their heads had swollen to an extraordinary size, and their features had become indistinguishable; and they might have been taken for monsters rather than men (Obs. ii. 33, t. 25, fig. dextra; 1725).

According to Molina (Hist., Engl. ed. 144; 1809), "the effluvium from this tree, especially in summer, produces painful pustules and swellings on the hands and faces of those who stop beneath its shade. This effect is various, however, with various persons: there are some who are very little, if at all, incommoded by it, while others, who merely pass by the tree, are severely affected; though never attended with fatal consequences, it is, nevertheless, very troublesome. Great precaution is requisite in cutting the tree, as its viscous juice is extremely caustic; but when dry, the wood loses all its injurious qualities." Molina, who has been described as "one of the most pernicious blunderers who have brought confusion into Natural History" (J. Ball, Notes Nat. S. Am. 175; 1887) is not very trustworthy; but, according to Gillies, "the statement made by Molina, relative to the poisonous nature of this tree, seems to be well founded; as I am informed, by several intelligent people, that individuals resting or sleeping under it at certain times of the year, are afterwards attacked with eruptions all over the body" (Hook. & Arn. Bot. Beechey's Voy. 16; 1832).

C. Gay (Fl. Chil. ii. 44; 1846) stated that the "Liti" or "Litre" tree (*Lithræa caustica*) is common on hills and sun-exposed plains in central Chile, extending from Coquimbo to Arauco; and that the danger of remaining underneath it or of burning it is well known. It is mostly women, children, and persons of weak constitution who are affected.

Another anacardiaceous tree well-known in subandine America as producing dermatitis is *Rhus juglandifolia* H. B. K. (Nov. Gen. Sp. vii. 8, tt. 603, 604; 1825). Humboldt and Bonpland were sceptical as to the alleged ill-effects of remaining under the tree without actual contact taking place. "Lac aquosum, quod arbor stillat, in cute post 2 vel 3 dies ejicit pustulas similes variolis, quamobrem incolæ non solum succum sed etiam umbram arboris metuunt, fabulantes eam noxiam esse, præsertim quando post pluvias sol arborem calefecit. Sunt tamen, qui nec post contactum, nec post tritum ullum sentiunt effectum adversum" (*l. c.* 9).

Triana, on the other hand, was satisfied that the popular idea of the "shade" of the tree being dangerous was well-founded. "Le *Rhus juglandifolia* exerce une actione curieuse sur l'homme: l'ombre seulement de l'arbre ou ses émanations, son contact, son approche, la fumée de son bois, produisent, suivant les individus, une irritation avec gonflement accompagné de démangeaisons. L'intensité de ces accidents est presque nulle pour certaines personnes, plus ou moins grave pour d'autres. L'un de nous [Triana] a éprouvé ces effets en récoltant et en desséchant la plante; même action sur une autre personne qui l'avait touchée. Les gens du pays combattent ces affections en faisant des frictions avec de la graisse ou avec de la crème" (Ann. Sc. Nat. sér. 5, xiv. 289; 1872). Triana's evidence as to the poisonous nature of *Rhus juglandifolia* seems to have been overlooked (Kew Bull. 1898, 100).

The poisonous character of *Gluta renghas* was known to Rumphius (Herb. Amboin. ii. 259, t. 86; 1750), a translation of whose remarks was given by Jack (Hook. Comp. Bot. Mag. i. 268; 1835): "The exhalations of this tree are considered noxious, and the people of Macassar and other parts of Celebes in particular, entertain such dread of it, that they dare not remain long under it, much less repose beneath its shade; they say that whoever receives the droppings from it will have his body swell and be affected with malignant sores."

Linnæus published the species as *G. benghas*, evidently with the intention of employing the vernacular name as a trivial. As the Malay name is "rengas," and "benghas" is meaningless, it seems desirable to alter the specific name to *G. renghas*.

According to Ridley (Malaya Med. Journal, ix. pt. 2, 11; 1911), "not only are the fruit, leaves and twigs of the Rengas trees [species of *Gluta* and *Melanorrhœa*] poisonous, but the timber also, even after long keeping, is apt to produce injury. Dr. Brown says that he was informed that after years of seasoning, when the wood is cut up, it gives rise to painful and intractable eruptions on the hands and bodies of the workmen. The timber is a very handsome red wood, streaked more or less with black, and was formerly known as Singapore mahogany and much valued as a cabinet wood or for buildings. The Kedah Malays, on felling a tree, would leave it lying in the forest till the bark and sap-wood was rotted away or removed by termites, after which they said it was safe to move. As a furniture wood, however, it went out of fashion, as even after being made up it was said to seriously affect many persons living in the room with it, producing great irritation of the mouth, nose and throat, especially when it began to get old, worn-out and dusty."

Among other *Anacardiaceæ* known to produce dermatitis may be mentioned *Gluta coarctata* and *G. Wrayi* (Ridley, *l. c.* 8); *Mangifera odorata* (Ridley, *l. c.* 9); *Mauria birringo* (Triana, *l. c.* 291); *Melanorrhœa Curtisii* (Brown in Journ. As. Soc. Straits, xxiv. 83; 1891); *M. Maingayi* (Ridley, *l. c.* 10) and *M. usitata* (Watt, Dict. Econ. Prod. India, v. 210; 1891); *Pseudosmodingium perniciosum* (H.K.B. Nov. Gen. Sp. vii. 10; 1825); *Rhus diversiloba* (Pammel, Man. Poisonous Pl. 609; 1911); and *Semecarpus Anacardium* (Watt, *l. c.* vi. pt. 2, 500; 1893). Further examples will doubtless occur to botanists who have resided in the tropics. Enough has been said to show the widespread occurrence in the *Anacardiaceæ* of a principle, or principles, capable of causing dermatitis. Every anacardiaceous plant should be regarded as potentially dangerous until proved to be harmless.

[In this Journal for 1920, p. 173, Miss E. Philip Smith mentions that people in the confectionery trade suffer from dermatitis caused by Vanilla pods, and that this is believed to be caused not by the Vanilla itself, but by the use of oil of Cashew to improve the colour of the Vanilla pods. I should suggest, however, that it is actually caused by the Vanilla, for *Vanilla Griffithii* Rchb. fil., a wild plant common in the Malay Peninsula, contains a slightly milky latex, which when dropped on the hand or arm produces a very unpleasant irritation of the skin, as I know well by experience. It does not, however, produce the swelling or papulation that *Melanorrhœa* or *Gluta* does. This latex is used by native girls, mixed with oil to strengthen and thicken the hair, much as cantharides is used in Europe.—H. N. Ridley.]

MYCOLOGICAL NOTES.—VI.

By W. B. Grove, M.A.

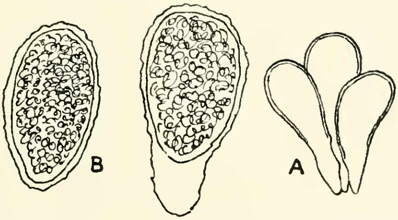
(Continued from p. 17.)

Milesina murariæ comb. nov.

Uredo murariæ P. Magn. in Ber. Deutsch. Bot. Gesell. 1902, xx. 611. Fisch. Ured. Schweiz, p. 538.

Uredo (*Milesina*?) *murariæ* Klebahn u. Lind. in Flor. Mark Brand. Pilz. v *a*, p. 851.

Uredosori hypophyllous, covered by the epidermis, small, inconspicuous, whitish, bullate, collected on yellowish fading spots of the leaf, often surrounded by a delicate at length wide open peridium, composed of more or less isodiametric translucent pale-coloured cells, which become elongated round the orifice and paler. Uredospores variable, roundish, ellipsoid, oval, or obovoid, 30–45 × 20–24 μ; membrane colourless, $1\frac{1}{2}$–2 μ thick, at first quite smooth, at length marked with rather few distant, irregular, not prominent warts; contents very granular, colourless; no germ-pores; each spore seated at first (when young) by a truncate base on a supporting cell as in *Melampsora populina*. The sorus is surrounded by 1–3 rows of clavate, hyaline, pedicellate paraphyses.



Milesina murariæ.—A, Paraphyses; B, Spore. The other figure is that of an intermediate form between a paraphysis and a spore. × 600.

On living leaves of *Asplenium Ruta-muraria*, Dundonald, Ayrshire (Boyd). Sept.–Oct., 1921.

This very rare parasite has been found in Scotland before (Crypt. Soc. Report, 1907), but was at that time included under the old *Milesia Polypodii* B. White. Its uredospores show it to belong to the genus *Milesina*, but it is different from *M. Blechni*, and other species of that genus, in having a circle of rows of clavate paraphyses round the sorus and in its irregularly warted (not echinulate) spores.

The peridium is not always present—at least, I could sometimes see no signs of it. On account of this and the paraphyses, this species resembles *Hyalopsora Feurichii* Fischer, which grows on *Asplenium septentrionale*. In fact, this latter is equally a *Milesina*, and should be called *Milesina Feurichii* Grove. The paraphyses are modified spores; the typical clear transparent paraphysis is shown at A, the very granular spore at B, but between these all possible stages can be seen, and some of the spores assume almost the pedicellate form of a paraphysis while still retaining the granular contents of a spore. When the real spore first falls from its supporting-cell, the base is evidently truncate, but afterwards it becomes rounded off.

The base of the proliferous stratum is a mass of hyphæ similar to those which can be seen in the intercellular spaces round the sorus. The hyphæ are rather coarse, colourless, much branched, septate, full of oil-guttules, and about 5–6 μ wide. The peridium does not extend underneath the spore-bed, and its cells do not present the least appearance of being abortive spores like those of the æcidium of *Puccinia*. In fact, the two peridia must be held to be in no way genetically related. The peridium of *Milesina* is a primitive and imperfectly evolved protective covering formed from the mycelium, while that of *Puccinia Caricis* is a beautifully perfect shield formed by abortive spores which take on the function of protection in lieu of reproduction.

UREDO ANTHOXANTHINA Bubák in Annal. Mycol. 1905, iii. 223. Kleb. u. Lind. in Flor. Mark Brand. Pilz. v *a*, p. 881.

Uredosori numerous, on yellowish or faintly reddish spots of the leaves, amphigenous but mostly epiphyllous, oval, about ½ mm. long, pale rusty-brown, erumpent, soon naked and surrounded by the upturned margin of the epidermis. Uredospores roundish or (mostly) oval, 18–24 × 16–20 μ; contents, when fresh, oily and bright yellow; membrane almost colourless or pale yellowish, or even brownish, 1½ μ thick, echinulate (distance apart of the spines 1½ μ), germ-pores indistinct: paraphyses very numerous, 60–70 μ long, often bent, thickened towards the apex with a capitate swelling, or often two, one above the other, 12–19 μ wide; membrane colourless or faintly yellowish, 3–5 μ thick, contents often yellow.

On leaves of *Anthoxanthum odoratum*. Aberystwyth (Miss K. Sampson); Ayrshire (Boyd); Worcestershire. May–July. Dr. Wilson's Perthshire specimens may be the same.

This species will doubtless be found to be common, if looked for in the right places, which in my experience are rubbish-heaps by the roadside, far from towns. The most remarkable fact about the sori is that the paraphyses are extremely numerous, often more than twice as many as the spores in the same sorus. No doubt this is the uredo of "*Puccinia anthoxanthi*" Plowr., but it is not *P. anthoxanthi* Fckl. After seeing the huge quantity and luxuriance of growth of the paraphyses in the specimens noted above, it is impossible, without overpowering evidence, to believe that the form without paraphyses which has been found in Germany and Australia, and now in Britain, can be the same. In all probability these are two distinct species, but whether one of them is *P. borealis* Juel is very questionable.

No teleutospores could be found. It seems possible that *P. anthoxanthi*, as recorded by Plowright (p. 194), was formed by adding the paraphyses which he observed to Fuckel's description. If so, "*P. anthoxanthi*" Plowr. has never existed.

PUCCINIA ANTHOXANTHI Fckl. Symb. Myc. Nacht. ii. 15.

Uredosori much the same as in *Uredo anthoxanthina* Bub., but fewer and narrower. Uredospores ellipsoid or subovoid, brownish-yellow (without bright yellow contents), rather coarsely echinulate (distance apart of the spines $2–2\frac{1}{4}\,\mu$), provided with about 3 germ-pores, $22–26 \times 15–20\,\mu$; *no paraphyses*. Teleutosori on the stems and sheaths, inconspicuous, similar to the uredosori, but not so erumpent; teleutospores oblong, obovoid, or subpyriform, obtusely rounded above, pale brown below, thickened at the apex ($4–6\,\mu$) and dark chestnut-brown, gently constricted, attenuated or rounded below, $32–35 \times 18–22\,\mu$; pedicels persistent, up to $20\,\mu$ long, rather stout ($4–6\,\mu$), faintly coloured but always dark chestnut at the summit just below the spore; mesospores intermixed, numerous, similar in colouring, but paler, about $25 \times 18\,\mu$.

On *Anthoxanthum odoratum*. Aberystwyth (Miss K. Sampson). June.

Uredospores, mesospores, and teleutospores often occurred in the same sorus. This is exactly the species described by Fuckel, Sydow, and McAlpine, and can hardly be confounded with the preceding. It will be noticed that Miss Sampson was successful in finding both species at Aberystwyth.

UREDO AMMOPHILINA Kleb. u. Lind. in Flor. Mark Brand. Pilz. v *a*, p. 882, fig. Y 4.

Uredosori scattered in short series in the grooves of the upper side of the leaf, at first covered by the inflated epidermis, then naked, orange. Uredospores oval, $27–29 \times 21–26\,\mu$; membrane pale yellowish or colourless, $1\frac{1}{2}\,\mu$ thick, echinulate (distance apart of the spines $1\frac{1}{2}–2\,\mu$), with 6–7 rather distinct scattered germ-pores; cell-contents bright orange; paraphyses capitate, $65–90 \times 14–21\,\mu$, with a thin pale yellowish membrane, scattered through the spore-layer, or more rarely not present.

On leaves of *Ammophila arenaria*. Borth. May–July. This fungus was first brought to my notice by Dr. Jessie Bayliss Elliott: when the leaves are in the rolled-in state, the sori are of course completely concealed.

There is another similar fungus recorded on *Ammophila*, viz. *U. ammophilæ* Syd. in Hedwig. 1900, xxxix. 121, from the Isle of Rügen. This is said to have no paraphyses, the cell-wall is thicker ($2–6\,\mu$), and the spines more distant; moreover, the sori are described as being hypophyllous (never epiphyllous) and as usually occupying the whole of the surface. Both Uredos are unattached, no teleutosori having been yet discovered. Even on the dead *Ammophila* Sydow found no teleutospores, but, as the uredospores resemble those of *Rostrupia Elymi* (which occurs on the same beach at Rügen), he suggests that this also may be a *Rostrupia*. Klebahn and Lindau state (*l. c.*) that the host of this fungus at Rügen is not *A. arenaria*, but *A. baltica*, which they speak of as a cross between *A. arenaria* and *Calamagrostis*.

Since our specimens of *U. ammophilina* often show sori containing absolutely no paraphyses (but otherwise identical) on the same leaves with those which have paraphyses in great abundance, it does not seem quite certain that the two supposed species are really distinct.

? UREDO FESTUCÆ DC. in Flor. Fr. vi. 82. Kleb. u. Lind. *l. c.* p. 883.

On *Festuca ovina*, *F. rubra*, *F. duriuscula*, at various places, King's Norton, Alvechurch, Droitwich, Hereford, etc., I have found, at distant intervals and always in small quantity, a *Uredo* with spores similar in some respects to those of *Puccinia dispersa*. The uredospores are often perfectly or nearly spherical, more rarely broadly oval; they have brownish-yellow walls ($1\frac{1}{2}\,\mu$ thick), which externally are not so much echinulate as covered all over with little stumpy points. The germ-pores, usually 4–6, are like those in *P. dispersa*. The sori are small, always buried in the leaf-tissue, generally near to the middle line, at first orange, then as they get old brownish-black, and becoming more prominent, but never pulverulent. There are no paraphyses. The tissue round the young sori is widely and conspicuously yellowed, and, as the sori are often in a single line down the middle of the narrow leaf, it presents a brindled appearance, after the style of *Eulalia zebrina*, with alternate bands of green and yellow.

No teleutospores have been found at any time on the same plants, although looked for, and therefore it is quite uncertain to what species the *Uredo* should be assigned. It does not seem likely to be *Puccinia festucæ* Plowr., and it is certainly not *P. festucina* Syd. It might be *Uredo festucæ* DC. (found in France and Germany on *F. glauca*), but the spores are never in the least pyriform. Klebahn suggests that this latter Uredo may belong to *Uromyces ranunculi-festucæ* Jaap, which can be nothing but a form of *Uromyces festucæ* Syd. What is required is to discover the teleutospores, without which one cannot arrive at any conclusion.

On *Festuca ovina* I have also found a different Uredo, with paraphyses which suggest that it might belong to *Puccinia gibberosa* Lagerh., but here again there are no teleutospores, and the quantity found has always been too small to permit of a decision.

MELAMPSORA SALICI-PENTANDRÆ Kleb. In *British Rust-Fungi*, p. 345, I mention the probability that this species had been found in England on *Salix fragilis*. I have also seen (*Irish Naturalist*, 1912, p. 112) an Irish specimen, on *S. pentandra*, which is assigned to the same *Melampsora*. Since then I have received from Mr. Boyd an Ayrshire specimen on *S. pentandra*, which is undoubtedly the true species. It is easily distinguished by its very minute teleutosori, which occur on both surfaces of the leaves, though especially abundant on the upper surface.

THECOPSORA GALII De Toni. This very rare fungus is recorded, in *British Rust-Fungi*, p. 370, only on *Galium verum*. Mr. Boyd has sent me excellent specimens on *Galium saxatile*, from several localities in Ayrshire, Buteshire, Renfrewshire, and Dumfriess-shire, as well as some on another known host, viz. *Asperula odorata*, from Dalry, Ayrshire. In several instances Mr. Boyd noticed that the affected *Galium* was growing in the neighbourhood of Fir-trees.

MELAMPSORIDIUM ALNI Diet. in Engl. u. Prantl, Nat. Pflanzenf. 1900, I. i. 551. *Melampsora alni* Thüm. in Bull. Soc. Imp. Nat. Mosc. 1878, liii. 226.

Mr. Boyd has informed me that he occasionally finds, as at West Kilbride, Ayrshire, in woods where *Melampsoridium betulinum* is abundant, a few leaves of *Alnus* also affected by a *Melampsora*-like fungus; there is also in Herb. Kew. a similar specimen, with uredospores only, from Aberdeen. It was at first thought that this was merely the fungus on the Birch which had strayed accidentally to the Alder, but, in view of the fact that the parasite named above has been found on *Alnus incana* and other species in Siberia, Japan, and Ecuador, it is possible that it may be found here also; it is desirable that it should be looked for further in suitable districts. The differences from *M. betulinum* are very small, except for the host-plant, but so far as they go the British specimens seem to be in agreement with them.

The dangerous parasite next to be noticed differs from the others contained in this series in being an exotic species:—

Placophomopsis, gen. nov.

Pycnidia iis *Phomopsidis* subsimilia, at solidiora et subiculo vel stromati tenui, quasi *Placosphæriam* in memoriam revocanti, insidentia. Sporulæ aliæ fusoideæ, aliæ filiformes hamatæque.

Placophomopsis Heveæ, sp. unica.

Subiculo effuso, ex hyphis atrobrunneis valde ramosis 2–3 μ crassis efformato, stratum continuum atrum inter peridermium corticemque sistente, quo denique peridermium excutitur. Pycnidiis dense in subiculo gregariis, subinde seriatis, atris, depresso-globosis, 200–400 μ diam., poro vel rimula apertis; contextu crassissimo, parte exteriore atro-brunnea, interiore olivaceo-brunnea. A-sporulis elliptico-fusoideis, plerumque utrinque subacutatis, interdum apice rotundatis, biguttulatis, maturis $7–8 \times 2\ \mu$, sporophoris subulatis, rectis curvulisve, apice acutis, $15–18 \times 2–2\frac{1}{2}\ \mu$, ferme achrois suffultis: B-sporulis filiformibus, sæpe curvatis v. hamatis, $20–30 \times \frac{3}{4}–1\ \mu$, sporophoris brevibus suffultis.

Hab. in truncis *Heveæ brasiliensis*, in plantario imperiali, Kampala, Uganda (alt. 1260 m.), Oct. 1920—leg. Snowden, no. 672.

This fungus, which Dr. E. J. Butler, Director of the Imperial Bureau of Mycology, kindly communicated to me, is presumably the pycnidial stage of a *Diaporthe*, and possibly of *Diaporthe Heveæ* Petch (Ann. Roy. Bot. Gard. Peraden. 1906, iii. 3; *Diseases of Rubber Tree*, 1921, p. 263. Sacc. Syll. xxii. 381). The pycnidia are at first completely hidden, then they cast off little fragments of the periderm and become visible through the hole, but without projecting. Afterwards the periderm is thrown off in sheets 2–3 cm. broad, but it never becomes blackened externally. Ultimately the pycnidia fall out, leaving little pale depressions in the subiculum. A- and B-spores may be found in separate pycnidia, but, if in the same, the A-spores usually predominate. The texture of the wall is especially thick, being composed of 10–12 layers of dense pseudoparenchyma, of which only the outer two or three are dark brown.

THE POLLINATION OF THE PRIMROSE.

By A. A. Dallman, F.C.S.

Although heterostylism is now so familiar a feature in certain species, it does not appear—at least, so far as the genus *Primula* is concerned—to have been noticed by the older botanists. It was not until the close of the eighteenth century that William Curtis (Fl. Lond. fasc. vi. t. 16) mentioned the two flower forms in *Primula acaulis* L. (*P. vulgaris* Huds.), and this appears to be the earliest reference to heterostyly in the Primrose. Some seventy years later the subject engaged the attention of Charles Darwin, who, on November 21st, 1861, read before the Linnean Society a paper "On the Two Forms, or Dimorphic Condition, in the Species of *Primula* and on their remarkable Sexual Relations" (Journ. Linn. Soc. (Bot.) vi. 77); in this four species—*P. vulgaris* Huds., *P. veris* L., *P. sinensis* Sabine, and *P. Auricula* L.—received special notice. The morphological and anatomical differences subsisting between the two forms of flower in each species are dealt with and considered in conjunction with the experimental results from different types of cross-pollination. Darwin emphasises these facts, and shows that the occurrence of floral dimorphism in *Primula* must be regarded as a device "to favour the intercrossing of distinct individuals." This formed the foundation of his further work on heterostyly, which was brought together in 1877 in his book entitled *Different Forms of Flowers on Plants of the same Species.*

The mode of pollination of the Primrose—and to a less extent of the Cowslip—has long been a matter of doubt. Darwin himself was conscious of this difficulty: in his paper he states (p. 85):—"I have watched Primroses more attentively during several years, and have never seen an insect visit them; yet from their close similarity in all essential respects to Cowslips, there can hardly be a doubt that they require the visits of insects. Hence I am led to suppose that both Primroses and Cowslips are visited by moths." Later (*Forms of Flowers*, p. 56) he writes:—"The Primrose is never visited (and I speak after many years' observation) by the larger humble-bees and rarely by the smaller kinds; hence its fertilisation must depend almost exclusively on moths." A careful perusal of Darwin's various writings on the subject shows that he considered the pollination of the Primrose was mainly accomplished by nocturnal Lepidoptera, and to some slight extent by *Thrips*. It should be observed, however, that this was merely a supposition, for neither he nor later writers have actually seen moths visiting the Primrose. Various subsequent writers have, however, stated it as a fact: thus Lord Avebury says of the Primrose (Life History Brit. Fl. Pl. 269: 1905):—"It appears to be mainly fertilised by moths."

Although a number of visitors are on record for the Primrose, yet careful investigation of the evidence adduced indicates its insufficiency. In this connection Mr. Burkill (Journ. Bot. 1897, 186) writes:—"The fertilization of this plant is still unexplained. None of the insects seen on it through many hours of watching are sufficient for its fertilization . . . . . The doubt does not end with our own shores. Knuth at Kiel has failed to observe insect visitors, and Cobelli in the Tyrol can, besides four beetles and Thrips, only name one butterfly (*Gonepteryx rhamni*) as a visitor capable of cross-fertilizing the plant. He specially notes the fact that bees avoid it." Knuth, however, subsequently modified his statement; in his *Handbook of Flower Pollination*, p. 69, he records (1909) *Bombus hortorum* and *Anthophora pilipes* as visitors.

In 1902 the Rev. E. Bell gave some account of his own very extensive field-observations (*The Primrose and Darwinism*), and stated (p. 30–1) that he had only noticed four insect visitors "after seeing and examining thousands and thousands, we might say millions, of the flowers." He concluded that "the Primrose gives unimpeachable evidence that self-fertilization of heterostyled plants is the natural and legitimate fertilization as being fully productive." Bell's book contains much that is of a polemical nature, but his observations are those of an able and accurate naturalist and an original and painstaking observer.

In 1903, the problem attracted the attention of Professor Weiss, who in April of that year devoted eight days at Church Stretton (Shropshire) to an endeavour to secure further information. He records (New Phyt. ii. 99–105) five types of visitor in this area, these, in order of frequency, being *Andrena Gwynana*, *Bombylius major*, *Anthophora pilipes* (misrecorded as *A. furcata* Panz.; see *Nature Notes*, xv. 104 (1904)), *Bombus terrestris*, and *Apis mellifica*. He writes:—"There is no doubt in my mind that Primroses are efficiently cross-pollinated in the district under observation by *Bombylius*, *Anthophora*, and *Andrena* with the addition of occasional, though by no means isolated visits of *Bombus*." "The fact that many observers have been unable to detect such insect visitors I attributed to their observations having been made either in cool or dull weather, or in exposed and windy situations. For even on sunny days I could not observe the usual insect visitors in wind-swept localities, while, at the same time, in sheltered positions some larger humble-bees might occasionally be met with." He concludes:—"From observations I have made on the Primrose I feel convinced that it is both regularly visited and cross-pollinated by insects under favourable climatic conditions, but that, like most flowers adapted to the visits of insects, it is provided with efficient means of self-pollination, and these are important to a plant flowering at so early a period of the year when the visits of insects may be precarious."

Weiss's paper, which represents a distinct advance and helps to reconcile conflicting views, was followed by a critical review by Bell (*Nature Notes*, xv. 63–8; 1904), who held that the length of the corolla-tube of the Primrose (12–16 mm.) "excludes the vast majority of insects, and even the majority of what are called the long-tongued insects, as the humble-bees, from reaching the nectar. The humble-bees consequently are not accustomed to visit it." Only one humble-bee (*Bombus hortorum*) could reach the nectar with any facility, while it is inaccessible to the hive-bee (*Apis mellifica*). He dismisses Scott Elliot's meagre statement (Fl. Dumfriessh. 114; 1896)—"*Bombus hortorum*, regular and sufficient visitor"—as unsatisfactory and lacking confirmation. As the flowering-period is too early for butterflies to be about in any number, there only remain two genera of insects (*Bombylius* and *Anthophora*) with probosces sufficiently long to reach the nectar. Bell's posthumous paper was followed by one from Weiss (N. Notes, xv. 103–6), who deals further with some of the points in dispute. One of the latest authoritative pronouncements on the subject is by Knuth (*op. cit.* 69), who states that the Primrose "is chiefly pollinated by long-tongued Hymenoptera and the brimstone butterfly, while Bombyliids, *Vanessa urticæ*, and the honey-bee are visitors of secondary importance."

The following may be regarded as practically a complete list of all visitors so far observed and recorded for the flowers of *P. vulgaris*:—

HYMENOPTERA.

Andrena Gwynana Kirb. South of England (T. Archer Briggs); Yorkshire Coast (Burkill); Shropshire, frequent (Weiss).

Anthophora pilipes Fab. (*A. acervorum* L.). South of England, frequent (Briggs); Essex (Miller Christy); Shropshire (Weiss); Kiel (P. Knuth); Alsen (Germany) (W. Wüstnei); Berlin (E. Loew).

Apis mellifica L. Essex (Christy); Shropshire (Weiss); Germany (Knuth).

Bombus sp. Essex (Christy).

B. hortorum L. Dumfriesshire (Scott Elliot); Kiel (Knuth).

B. terrestris L. Shropshire (Weiss).

B. lapidarius L. England—a single instance (Bell).

LEPIDOPTERA.

Gonepteryx rhamni L. South of England (Briggs); Essex (Christy); England (S.?) (Bell); Austria (Cobelli); Germany (Knuth).

Pieris rapi L. Essex (Christy).

P. brassicæ L. England (S.?)—only once (Bell).

Vanessa urticæ L. Germany (Knuth).

DIPTERA.

Bombylius major L. Shropshire and N. Staffordshire, frequent (Weiss).

B. discolor Mikan. South of England, frequent (Briggs); recorded as *B. medius*, but doubtless *B. discolor*).

B. medius L. Austria (Cobelli).

Syrphus sp. Essex (Christy).

COLEOPTERA.

Anthobium primulæ Fauv. Yorkshire coast (Burkill).

Meligethes picipes Sturm. Essex (Christy); Yorkshire coast (Burkill).

ORTHOPTERA.

Thrips sp. England (Kent?) (Darwin); Austria (Cobelli); Yorkshire coast, frequent (Burkill); England (S.?) (Bell).

My own observations have been made chiefly in North Wales between 1911 and 1919 during occasional visits in connection with the investigation of the flora of Flint and Denbigh. Miss E. Bray, of Hailsham, Sussex, kindly agreed to help, and, being more favourably situated, both as regards the abundance of Primroses in her neighbourhood and opportunity for watching the flowers, her observations are of special value. It should be noted that while observations in North Wales were largely nocturnal, those made by Miss Bray were chiefly diurnal.

Great care has been taken to secure accurate identification of the various visitors observed, and in this connection it is a pleasant duty to express my obligations to various zoological friends, especially Messrs. H. Britten, J. R. Hardy, J. W. Jackson, and Dr. W. M. Tattersall, of Manchester; Mr. H. Bury (Stockport); Dr. A. R. Jackson (Chester); Dr. C. H. Murray (Liverpool); and the Rev. F. D. Morice (Woking).

NORTH WALES.

1. *Cwm, Flintshire.*

Cwm, where my earliest observations were made, is a secluded hamlet in North Flintshire, some three miles or so north-east of St. Asaph. The valley or cwm is bounded at its upper end by Moel Hiraddug (Carboniferous Limestone) to the North and Mynydd-y-Cwm (Wenlock Shale) to the South, these two eminences forming the northern termination of the Clwydian Range. Bryn-Goleu—which forms the centre of the Cwm observations—lies a little above the village and at the head of the valley and almost on the division between the two formations. From this point (600 feet above sea-level) the cwm descends westerly and merges with the Vale of Clwyd. The extremity receives its full share of the prevalent west winds, and the situation is a fairly sunny one.

Here the Primrose occurs abundantly, especially on the hill-slopes, and along the hedge-banks, lane-sides, and field-borders. Its flowering period normally extends from March to May, attaining its zenith by the latter half of April. Precocious flowers may often be met with long before March in mild seasons, and occasionally occur in December. In the season of 1911 it began to bloom at Cwm on March 4, while by May 27 only an occasional flower was to be found.

Staying at Cwm (April 13–19, 1911) I was able to devote attention to the Primroses. The garden at Bryn Goleu has been enclosed from the surrounding hill-slope; it has a western aspect and is quite open at the front. There are many Primroses in the turf of the wild part of the garden, some relics of the original wild flora, while others have been added from the neighbouring slopes.

April 14 was a bright sunny day with some wind, and the display of Primrose bloom at Bryn Goleu was kept under observation from 11 to 1. Although my friend Mr. R. H. Day had three hives of bees within a few yards of the flowers, and all were working vigorously, they ignored the Primroses. This was the more noteworthy, as there were a number of flowering clumps quite close to the hives and in the direct track of the workers as they passed to and fro. Mr. Day informed me that he had often noticed the fact that the hive-bees did not visit the flowers of the Primrose. On the present occasion *Apis mellifica* was collecting from various flowers, and I observed it at work on White Rock (*Arabis alpina*), Wallflower, American Currant (*Ribes sanguineum*), Dandelion, Barren Strawberry, Gorse, and Willow. No humble-bees came to the Primroses, though they frequented the Willow catkins and other flowers. Although the grassy bank upon which a special watch was kept was occupied by large and conspicuous groups of Primroses, the only visitors observed during the two hours were numerous small Coleoptera (*Meligethes picipes*) and a fly (*Lucilia cæsar*). The latter was only noticed as an occasional visitor, and appeared to be resting rather than attempting to obtain food. I observed that this Dipteron and certain other flies constantly visited numerous interspersed Daisies for pollen or nectar, or both. The following day was fine and sunny, but a chilly wind prevailed. On this occasion the grassy banks of the lane to Rhuallt were kept under observation for some time (11 to 1.0). Thousands of flowers occurred along the half-mile or so distance regularly patrolled, but I did not observe a single bee, nor were other winged insects seen on the Primroses. The flowers here, as at Bryn Goleu, were tenanted by numbers of a species of *Thrips*; this appears to occur wherever the Primrose is met with, and is doubtless a factor, as Darwin admits, in assisting self-pollination of both types of flower.

It seems rather remarkable, especially in view of Darwin's statement that the Primrose is pollinated by moths, that no careful actual observations have been made at night-time. As the plant shows certain features of Müller's "lepidopterid flowers," it seemed desirable that investigation should be made. My interest had been further aroused by noticing numerous instances of Primroses in which the corolla had been more or less gnawed or devoured; in some cases the flower had been attacked to such an extent that only the corolla-tube remained. In many cases (especially in the short-styled type) stamens and occasionally the entire andrœcium had been removed; in other examples (particularly in the long-styled type) the stigmas had disappeared. Such mutilation is not peculiar to the Cwm area; I have subsequently observed it in many localities in counties as far apart as Denbigh, Bute (Isle of Cumbrae), Dumbarton, York, Ayr, Cheshire, and Renfrew. Some of the mutilated flowers about Cwm (as others elsewhere) bore evidences of the visits of slugs or snails, and emphasized the desirability of nocturnal observations. A row of fifteen plants, with perhaps about 110 open flowers, on a grassy bank at Bryn Goleu, was visited on three nights (April 14, 15, 17) and patrolled at intervals for periods varying from fifteen minutes to an hour between 8.30 and 10.45 P.M. An electric flash-lamp was used to inspect the flowers periodically. Taking these three occasions together, the flowers were found to be visited by the following:—6 *Forficula auricularia* N., 3 *Meligethes picipes* Sturm, 2 *Otiorhynchus picipes* Fab., 2 *Limax agrestis* L., 1 *Otiorhynchus ligneus* Oliv., 1 *Sciaphilus muricatus* Fab.

The three nights were rather chilly; on the 14th and 15th there was a cold wind which was very unfavourable for my purpose.

April 16 was cold, wet, and windy, at night, and quite unsuited for making any observations. A few moths were flitting about on the first night, but no nocturnal Lepidoptera were seen to visit the Primrose either then or on any subsequent occasion. Three of the four larger Coleoptera (*Otiorhynchus* and *Sciaphilus*) were feeding on the petals, while the fourth was apparently devouring the anthers of a short-styled flower. Several of the earwigs (*Forficula*) were observed with their heads inserted well into the mouth of the corolla-tube and feeding upon the pollen and anthers.

One of the slugs was devouring the stigma of a long-styled flower and the other had visibly modified the corolla of another. Several blossoms showed distinct traces of recent visits by Gastropoda, the silvery trail on the corolla—sometimes also on stigma (long-styled) and andrœcium (short-styled)—being unmistakable. I have not included in the foregoing list a couple of Lepidopterous larvæ which were observed on the flowers—one (April 14) was a small Looper Moth caterpillar, one of the Geometridæ, the larger was evidently some species of *Triphæna*. I do not think these were more than accidental visitors or of any significance in regard to pollination. It may be added that the various moths of the genus *Triphæna* are not in evidence until the flowering-period of the Primrose is past.

Five of the species in the above list of nocturnal visitors have not been previously recorded in connection with the Primrose. Comparatively few plants were kept under night observation, and that for a relatively short period—about two and a half hours in all,—while the climatic conditions were not too favourable. Mr. Day, who made occasional nocturnal observations at Bryn Goleu after I left wrote (early in May) that he had seen "the usual visitors, snails, slugs, earwigs, thrips, and two kinds of beetles."

Another visit was paid to Cwm the following year (April 20–25). The climatic conditions on this occasion were fairly favourable and there was less wind, though some nights were rather chilly. The same fifteen plants at Bryn Goleu were visited on five successive nights between 8.30 and 10.30. The periods of observation ranged from ten minutes to an hour and only represented about two hours in all. The following were seen:—13 *Forficula auricularia* N., 3 *Otiorhynchus picipes* Fab., 3 *O. ligneus* Oliv., 2 *Meligethes picipes* Sturm., 2 *Limax agrestis* L., 2 *Helix* sp., 2 *Porcellio scaber* Lath., 1 Araneid.

The total is nearly double that of the previous list: the more congenial climatic conditions on this occasion and the fact that these observations were a week later may have some bearing on this. Moths were seen flying about the garden on three nights, but none visited the Primroses. Several of the earwigs were again observed feeding on the anthers; the two specimens of *Helix*—a much larger snail (probably *Helix aspersa* Mull. or an allied species) than *H. hispida* L., which was seen on flowers at Erbistock—were both feeding on corollas, and were probably the same species of snail as observed here by Mr. Day in 1911. The two woodlice (*Porcellio* *scaber*), which were seen on separate nights, were unexpected additions and an unusual type of flower visitor. Neither Müller nor Knuth record any Isopoda as being agents in flower-pollination. I believe *Porcellio* is a vegetarian, and, although I could not exactly decide what they were doing on the Primrose flowers, I suspect they were feeding on something. The spider was a moderate-sized example, which I did not capture. A small Geometer larva was seen on a flower (24th), but I do not think that this has any significance.

On April 22 I watched some Primroses for a short time (1.30 to 2.30). The day was warm and calm, with bright sunshine. There was a fair display of Primroses on a sunny roadside bank of southerly aspect just outside and west of Whitford (Flint). This locality is on the plateau of the Halkin Range, some five miles to the east of Cwm and at the same elevation as Bryn Goleu. A fair number of a small burrowing-bee was observed frequenting the flowers and collecting pollen. Specimens were subsequently identified as *Andrena Gwynana*. In a lane close to this spot a single humble-bee (*Bombus* ♀) was noticed on a Primrose, but whether collecting pollen or nectar I could not decide, as she quickly took to flight. This was either *Bombus terrestris* or *B. hortorum*.

(To be continued.)

THE VITALITY OF SEEDS.

The paragraph which we reprinted (p. 240) from the *Times* has attracted the notice of the Royal Botanic Society, whose *Quarterly Summary* for July contains an interesting article by the editor, Mr. J. L. North, Curator of the Society, on the subject, from which we extract the following passages. It may be noted that, in the version of the story which we printed, the "Morning Glory" (*Ipomœa purpurea*) was mentioned, whereas in the following account the "Moonflower" (*I. Bona-nox*) appears, but the absurdity is the same in either case:—

"In a newspaper a short while back there appeared a letter from a correspondent referring to some seeds of oats which had germinated after removal from a mummy 2,600 years old. As it is a good example of mummy stories, and this Society had something to do with the spreading of it, it may be interesting to Fellows.

"The particular mummy to which it refers was one presented to the late John 'Rob Roy' Macgregor, of canoe fame. When in the course of his wanderings (this was 50 years ago) he reached Egypt, the Khedive, Ismail, presented him with an unopened mummy in its case. After he came back to England it was opened in the presence of credible witnesses, and among the dust at the bottom was found four oat seeds. Two of these he sowed himself, and two he brought to these gardens. All four seeds germinated, his producing flowers and fruits; ours grew, but died without flowering. The story of their discovery and growth was put in the papers, and made a great stir at the time, while the fact that the Society had grown the seeds was held as proof of its authenticity.

"Not for a long time afterwards was any doubt cast upon the truth of it. Then a friend, who had lived many years in Egypt, told us that he very well remembered seeing the very coffins lying heaped up in the palace stables of the Khedive along with the fodder for the horses. It appeared that Ismail kept, as specimens of the most interesting product of his country, a store of mummies in their cases ready to present to distinguished visitors who came to see him.

"What doubtless happened was that the dry air of the stables, or the rough usage to which the mummy was subjected, caused the wood of the case to warp and split, or the clay luting joining the two halves to break, and through the interstices the oats filtered in. It had previously been noted as odd that only four seeds were found, and that these were of similar character to varieties then in cultivation.

"Echoes of this story are still to be heard. Only a week or two ago an inquiry was made by the editor of a newspaper as to whether it would be safe to publish an article from a contributor about some seeds of the moon-flower obtained from a bridal wreath found upon the head of a 5,000-year-old mummy of an Egyptian Princess, which had afterwards grown and flowered in America. My answer was in the negative. The story, though the author, not being a botanist, did not know it, was lacking in verisimilitude. The moon-flower, *Ipomœa*, is a native of tropical America, and for a wreath of it to have been found on the head of an Egyptian princess at that time meant that America must have been discovered by the Egyptians 4,600 years before Columbus, which is absurd."

Mr. North adds: "In an experiment I made some years ago with seeds of *Nelumbium* from Egypt, the seeds were kept in an incubator, in water at 90 degrees, for three months. At the end of that time they were still so hard it was only possible to break them with a hammer. I then tried scratching the skin of some with a file, and to my surprise these germinated in 24 hours."

Mr. Carruthers contributed to *Nature Notes* for January, 1895, an interesting paper on the alleged germination of mummy wheat, which we may at some time reprint. In the course of this he refers to the most authentic case of old seeds germinating, as established by Robert Brown on seeds of a *Nelumbium*. These had come from Sloane to the British Museum, in the Botanical Department of which they still are—the *Quarterly Summary* erroneously places them in the College of Surgeons: they had certainly been in the boxes in which Brown found them for a hundred and fifty years.

CRITICAL NOTES ON SOME SPECIES OF *CERASTIUM.*

By Frederic N. Williams, F.L.S.

(Continued from Journ. Bot. 1899, 477.)

[A provisional classified list of the species of *Cerastium* was printed in Bull. Herb. Boiss. 1898, pp. 893–904, and includes 123 species:—

Subgenus I. Dichodon (4 species).
Subgenus II. Strephodon.—Ser. 1. Recticapsulares (26 species).
Ser. 2. Curvatocapsulares (1 species).
Subgenus III. Orthodon.—Sect. 1. Cryptodontia (2 species).
Sect. 2. Schizodontia (9 species).
Sect. 3. Cheileodontia (81 species).

This last, the largest section, is likewise divided into two series,—

1. Recticapsulares (37 species), and
2. Curvatocapsulares (44 species).

Grenier, in his monograph of the genus (1841), describes only 48 species.

The series of notes, in Journ. Bot. 1899, ended with *Cerastium fulvum*, in alphabetical sequence of published specific names; this sequence in the resumed notes is strictly followed, as a matter of convenience. For the purpose of uniformity and conciseness in any descriptions which follow, subgeneric and sectional characters as defined in the provisional classified list above mentioned are omitted. The numbering is continued, and the alphabetical sequence is resumed where the previous notes broke off twenty-two years ago.]

126. C. FURCATUM Chamisso & Schlechtendal, in *Linnæa*, i. 61 (1826).—Collected by Redowsky, in the course of the Romanzoff Expedition, in E. Siberia (without more precise locality). This collection is in the Herbarium of Petrograd. From recent communications received at Kew from Mr. Boris Fedtschenko—who, botanists will be pleased to know, is working at the Institute reserved in Petrograd as a refuge for men of science—it is probable that this famous Herbarium has not been damaged, still less destroyed, by agents of the Bolshevist government. It was with an account of Redowsky's collections that *Linnæa* started on its useful and brilliant career in 1826. The authors distinguish the plant from *C. ovatum* by its being more hairy and much smaller in all its parts. The name is mentioned (on p. 72) by Grenier in his monograph (1841), but is accidentally omitted from the index. Ledebour, Fl. Rossica, i. 407 (1842), regards it as a reduced and stunted form of *C. rigidum.* The original description differs hardly at all from that of *C. alpinum*, which is not uncommon in E. Siberia, to which also Torrey & Gray, Fl. N. Amer. i. 188, refer *C. rigidum* as a variety.

127. C. GAYANUM Boiss., Diagn. Pl. Or. nov. Ser. ii. fasc. 1. 92 (1854).—There is but one sheet of specimens in Herb. Kew., varying

from 2–4 ctim. in height, collected by Gandoger (Fl. Hisp. exs. n. 410 [1896]), in pine-woods near Bullias in Murcia. Restricted to Valentia, Murcia, and Aragon, in Spain, on sandy soil. Seems to be most nearly allied to *C. pumilum*. Mr. A. Bennett is, however, disposed to consider the latter (in its typical form) to be practically an endemic British plant, as it grows only on chalky banks in the south of England, and never on a sandy soil. It would be interesting to grow *C. Gayanum* on a chalky soil, and see what happens.

128. C. GIBRALTARICUM Boiss., El. Plant. nov. Hisp. 24, n. 37 (1838); et Voy. Bot. Espagne, i. 106 (livr. 5, 10 Fèvr. 1840), t. 32 (livr. 8, 20 Juin 1840); Kelaart, Fl. Calpensis, 217 (1846).—Perenne, laxe cæspitosum. Rhizoma turiones foliosos edens. Caules floriferi 5–30 ctim., erecti inferne foliosi, superne longe nudi, apice dichotomi. Folia sessilia, patentia interdum recurva. Dichasia pluriflora; flores magni, dichotomiarum longe, alares breviter pedicellati. Pedicelli filiformes apice incurvi, fructiferi erecti vel patentes. Bracteæ parvæ, superne margine late scariosæ. Sepala 5–8 mm., margine late scariosa. Petala calyce 2–3-plo longiora, obovata biloba. Capsula calyce 1½–2-plo longior, oblongo-cylindrica recta, nervis distinctis 10 percursa. Semina magna subgloboso-reniformia tuberculata rufa, testâ vesiculato-inflatâ, nucello vix ⅕ cavitatis perispermii occupante.

α viridis nobis (forma typi).—Folia læte viridia lineari-lanceolata nervo valido instructa, sparsim pubescentia. Caules, pedicelli cum sepalis dense glanduloso-pubescentes subviscidi.

Hab. Gibraltar; in abundance in clefts on the east side of the rock, in smaller quantity on almost every other part of the rock.—Spain; Sierra de Agua, near Carratraca, in prov. Malaga.

β niveo-tomentosum nobis: =*C. Boissieri* Gren. Monogr. 67 (1841).—Folia ovato-lanceolata cum caulibus molliter niveo-tomentosa. Pedicelli cum sepalis breviter glanduloso-pubescentes.

Hab. In the montane and alpine regions of Spain (chiefly in the south), Marocco, and Algeria. Up to 2700 m. on Sierra Nevada.

γ lanuginosum nobis: =*C. Boissieri* var. *lanuginosum* Gren. t. 7.—Totum piloso-lanatum, pilis glandulosis, etiam in pedicellis 1–3-floris et sepalis crispato-lanatis.

Hab. Sardinia.

This is "**C.** lineare" of Sardinian botanists, but not of Allioni, which is a plant of the Alps of Piedmont. *Cf.* also Barbey, Fl. Sard. comp. 219.

δ Salisanum nobis: =*C. physospermum* Gay MSS. in Herb. Kew. (1831), non ex Gren. Monogr. 67.—Inferne glabrum, superne tomentosum, pilis crispatis non glandulosis. Folia primaria viridia vix subtomentosa, novella autem fasciculatim ex axillis prodeuntia dense tomentosa, æque ac pedunculi calycesque. Capsula ovoidea, brevior quam in *α*.

Hab. Corsica. Mountains above Bastia (Salis, 1832, ex herb. Gay, in Herb. Kew.), and probably elsewhere in the island.

Syn.—*C. repens* (non Linn.) Salis in *Flora*, xvii. Beibl. ii. 72 (1834). Described from Salis' original specimens, which he sent to Gay. To this var. I also refer the *C. Boissieri* of Briquet's Prodr.

fl. Corse, 511 (Oct. 1910). He says,—"la lanuginosité est plus marquée à l'état estival (Juin, Juillet) lorsque les feuilles inférieures sont flétries"; and gives a clear figure of a section of the epidermal surface of a leaf, contrasting it with that which obtains in *C. stenopetalum*,—a plant also confined to Corsica.

There is some confusion in Grenier's reference to *C. physospermum*. In distinguishing his *C. Boissieri* from *C. arvense*, he says:—"seminibus imprimis multo majoribus, et perispermio lævissimo nucleis non adhærenti, ut in *C. latifolio* et *pyrenaico*, unde nomen *C. physospermi* Gay! servare non potui." What he could not keep up he does not say.

The type-form of *C. gibraltaricum* is described from specimens in Herb. Kew. from the original locality indicated by Kelaart, *l. c.* (*Willkomm* Iter Hisp. pl. exs. 1845, n. 615; *Ball*, 1851; *Munby*, 1856; ex herb. *Boissier*, type-specimens coll. 1837; *Lemann*, 1841; *Boissier & Reuter*, 1849; *H. A. Hurst*, 1868; *Hooker*, 1871).—*Cf.* syn. under note n. 50 (as to priority).

129. C. GLABELLUM Turcz. Fl. Baïcalensi-Dahurica, i. 243 (1843–1845).—There is a single sheet of four specimens in Herb. Kew. labelled "*C. arvense* var. *glabellum* Turcz." ex herb. Petropol. They are 18–21 ctim. in height, with leaves 12–13 mm. They were collected on a spur of the Yablonnoi mountains above the town of Aksha, in the E. Siberian province of Trans-Baïkalia, near the frontier of Mongolia. It seems to be an extreme state of a series of forms terminating at the other end with *C. arvense* var. *incanum*—"*Cerastio incano* Ledeb. in omnibus præter glabritiem simile. An varietas?" The essential part of the description is as follows:—"Erectum, glabrum, foliis lineari-oblongis vel linearibus acutis; floribus terminalibus subtrichotomo-paniculatis; petalis bifidis sepala oblonga margine membranacea duplo superantibus."

130. C. GLABERRIMUM Lapeyr., Hist. abr. pl. Pyren. 265 (1813), t. 101 (ined.?): = *C. alpinum* var. *glabrum* Retz. Fl. Scand. Prodr. ed. 1 (1779), ed. 2, 110 (1795); Willd. Sp. Plant. ii. 815 (1799). By the few authors who refer to it credited to the latter, but, as pointed out by C. A. Lindman in his recent Swedish Flora, p. 240 (1918), it was first definitely named by Retzius. The history of the plant is interesting. It was clearly distinguished by Linnæus long previously:—

Cerastium foliis lanceolatis glabris L. in Act. Soc. Lit. Sc. Suecicæ, iii. ann. 1732, 54 (Florula Lapponica); Fl. Lapponica, 151 (April, 1737); *C. alpinum* var. β L. Fl. Suecica, ed. 2, 159 (1755), et Mant. Plant. ii. 390 (Oct. 1771).

Linnæus says:—"We have here two forms, of which one has the leaves quite glabrous and almost shining, and the other has villous leaves, but they are not distinct species, as all parts of the plant even to the small parts of the fructification are similar. What then is the cause of the smoothness in the other plant, since the two forms occur together?"

This memoir of 1732 is the earliest printed and duly authenticated contribution of Linnæus to Botany. Of the two credited to him in the previous year (1731), J. M. Hulth supplies a note, the gist of which is here translated:—

(1) *Dissertatio de planta Sceptro Carolino.* The original MS. is in the University library of Upsala. On the verso of the first folio is the following remark by Linnæus himself: "I wrote this dissertation in one day, for the price agreed upon of 20 thalers. Another has the credit of it." It was duly read by J. O. Rudbeck, "the author," before the Upsala Society on 19 June 1731, and afterwards printed, with one plate included.

(2) *Hòrtus Uplandicus.* This list of plants, grown mostly in the Upsala Botanic Garden, and extending to 160 pages, is dated 1731. It remained in MS., and was not actually printed until 1888.

C. glaberrimum is published as a new species by Lapeyrouse, without any indication of its affinities or previous history.

Hab. Norway. Sweden (first indicated by Linnæus in Lappland). Arctic Russia. Austria (Carinthia). Italy (Carniola, until recently in Austrian territory). Rumania (in an area recently transferred from Hungary; = *C. alpinum* var. *a glabrescens* Schur, Enum. Pl. Transsilv. 22 [1866]). France (dept. of Pyrénées-Orientales—Canigou, Cambredage, Llaurenti, sec. *Lapeyrouse*).

131. C. GLABRATUM Hartman, Handb. Scand. Fl. 180 (1820).—A brief description in Swedish, coming before n. 3, *C. alpinum.* Identical with the preceding.

132. C. GLANDULOSUM Schur in Oesterr. Bot. Zeitsch. 1869, 306; = *C. triviale* var. *glandulosum* Reichb. Fl. Germ. excurs. 796, sub n. 4972 (1832).—Totum glanduloso-pilosum, bienne vel perenne. Caules multi curvato-adscendentes, a medio ramosi, 1–2½ dcm. Folia subrotundo-elliptica, radicalia ovato-spathulata subpetiolata, parum minora. Flores breviter pedicellati plusminus conferti, in dichasium digesti. Capsula apicem versus tenuiter curvata.

Hab. Dry grassy places on the Circus field of the Prater, Vienna. It has no claim to specific rank, and is no more than a very glandular state of the common form, with congested flowers, and a less curved capsule, perhaps nearest to *C. triviale* var. *canescens* Gürke, Pl. Europææ, ii. 225 (1899). Original specimens are in the Vienna herbarium.

133. C. GLOMERATUM Thuill. (1799).—Cosmopolitan and very variable. Ascends to 1350 metres in the Himalayas of Sikkim (Hook. f. Fl. Brit. Ind. i. 228); to 480 metres on the Grampians of Perthshire, on the east side of Helvellyn in Westmoreland, and in Dublin.

134. C. GLUTINOSUM Fries, Nov. fl. Suecic. (1814), et Fl. Hallandica, p. 51 (1817), *non* Fries, Herb. Normale, fasc. iv. n. 54 (1837): = *C. pumilum* Curtis, Fl. Londin. fasc. vi. n. 69, t. 30 (1794).—Neither of the two works of Fries is either in Herb. Kew. or in the Linnean Society's library, so that is probably why Ind. Kew. cites as the authority ed. 2 of the first citation. For the probable date of Curtis's n. 69 containing *C. pumilum* (1794, after 1 Aug.) *cf.* B. D. Jackson in Journ. Bot. 1881, 310. The letterpress of a plate in the same number refers to "this summer 1794 in the beginning of

August." The reduction of *C. glutinosum* to *C. pumilum* is due to Babington (in Ann. Mag. Nat. Hist. 1859, 20), and has been generally concurred in. By Willkomm & Lange (Prodr. fl. Hispaniciæ, iii, 633), however, they are still kept distinct, though with misgiving—"valde simile sed minus aut minime glanduloso-viscosum." There are Swedish specimens under this name in Herb. Kew. from Kigistatt (*Dr. A. P. Winslow*, 1879), Visby (*N. H. Nilsson*, 1822), and Limhamn near Malmö (*Murbeck*, 1888). Fries gives its distribution as S. Sweden, and founds the species on "Alsine glutinosa" of Gesner's *De stirpium nominibus* (1557).

135. C. GLUTINOSUM Hegetsch. Fl. Schweiz, 433, n. 1309 (1839).—The title-page of this is dated 1840, but a MS. note in the Kew copy states that the first portion was printed and issued in 1839. This is no more than a glandular state of *C. latifolium*,—not even up to a variety, as given by Gürke, Pl. Europææ, ii. 227. No Swiss localities are given, but it is stated to occur up to 2250 metres, and to be founded on *C. glaciale* (in parte), Gaudin in litt. 1814, in Cand. Prodr. i. 419,—which = *C. uniflorum* Murith, Guide Bot. Valais, 60 (1810). This last is well figured in Mr. H. S. Thompson's *Alpine Plants of Europe*, 86, t. xiv. 6 (1911). He says it occurs in débris of high siliceous Alps up to 3450 metres.

136. C. GLUTINOSUM H. B. et K., Nov. Gen. Sp. Amer. vi. p. 23 (in fol. 1823), et p. 29 (in ed. in 4°).—There are five sheets of specimens in Herb. Kew.,—from which the following description is drawn up (omitting sectional characters):—Subgen. Orthodon, Sect. Cheileodontia. Perenne, villoso-pilosum, glutinosum, fuscescens. Caules 4·5 dcm., adscendentes superne dichotome ramosi; internodia 12–24 mm., ramorum floralium 40 mm.; sub inflorescentia non geniculati. Folia 28 mm. long., 6 mm. lat., suprema minora bracteiformia, lanceolata angustato-acuta. Dichasium 3–9 florum. Pedicelli 16–24 mm., uniflori, filiformes, fructiferi erecti apice nutantes. Sepala oblonga acuta, 2 interiora margine anguste diaphana. Petala 9–10 mm., oblonga biloba flabellato-nervosa, breviter unguiculata, calycem superantia. Ovula circ. 25. Capsula membranacea, leviter curvata, calycem duplo superans, dentibus 8–9 mm. Semina ferruginea.

Hab. Andes of Colombia: ridge of Asuay at 3900 metres (*Jameson*, received 1865); Pasto, at 3400 metres (Voy. *Triana*, 1851–57). Andes of Quito: at 4200 metres (n. 46); plains of Quito (n. 303); Quito (*Jameson*, 1845); Pilezhuir at 3750 metres.

β *glabratum* nobis, var. nova.—Omnino glabratum. Rhizoma magis lignescens. Dichasium ad unum florem reductum. Petala paullum longiora, 10–11 mm. Capsula longior.

Hab. Andes of Colombia: Sierra Nevada de S. Marta, at 3300 metres, close to the north coast (1844). Described from specimens in Herb. Kew. marked "var. glabratum," without the name of the collector.—Evidently a high alpine and reduced form; much smaller than the type.

137. C. GNAPHALODES Fenzl in Russegg. Reise, i. 929 (1843).—Closely allied to *C. tomentosum*. First known from Asia Minor and Armenia. In Europe limited to Serbia.

138. C. GRACILE Dufour in Ann. Gen. Sc. Phys. vii. 304 (1820): =*C. tetrandrum* Curtis var. *alsinoides* Gürke, Pl. Europææ, ii. 234 (Jan. 1899). Authentic specimens were sent by Dufour to De Candolle from a rocky station on Sierra de Vernisa, near San Felipe de Jativa, prov. of Valentia, Spain (*cf.* Prodr. i. 416, n. 19). Referred by Grenier, Monogr. 43, to *C. pumilum*, but afterwards correctly referred by Townsend to *C. tetrandrum* (Journ. Bot. 1877, 35).

139. C. GRAMINIFOLIUM Rydberg in Bull. Torrey Bot. Club, 1903, 250.—Perenne, breviter denseque viscido-villosum. Rhizoma tenue ramosum. Caules 3–5 dcm., erecti, apice cymiferi, internodio summo infra anthemiam elongato, 5–10 ctim. Folia 2–3 ctim. long., 3–5 mm. lat., uninervia lineari-lanceolata acutata patentia. Bracteæ lanceolatæ vel ovato-lanceolatæ, late scarioso-marginatæ. Pedicelli apice curvati, fructiferi 2–4 ctim., apice reflexi. Sepala 5–6 mm., anguste lanceolata acuta anguste scarioso-marginata. Petala 12–14 mm., ⅓–¼ bidentato-lobata, lobis oblongis. Capsula leviter curvata nutans cylindrica, sepalis ⅔ longior.

Near *C. arvense*, but differs from the European plant in the more villous pubescence, the more acute leaves, and the larger flowers.

Hab. N.W. United States.—Washington: Pullman (*Elmer* n. 177, type in New York Botanic Garden)—Idaho: near Lewiston, Upper Ferry and Clearwater Ferry.—Montana: on Old Sentinel, a mountain near Missoula, at 900–1500 metres (*D. T. Macdougal*, 1901, n. 175). Here described from Montana specimens in Herb. Kew. (received 1905),—which had not come to hand when Rydberg described the plant.

(To be continued.)

FRANCES ARABELLA ROWDEN.

BY JAMES BRITTEN, F.L.S.

THE claims of this lady to a place in our *Biographical Index* are doubtless somewhat slight, although not more so than those of others who appear therein: she was herself, however, a personage of some interest, as the following account will, I hope, show. Such claims as she possesses rest upon her *Poetical Introduction to the Study of Botany*, which shows more acquaintance with the subject than is usually manifested by works bearing similar titles. The first edition, published in 1801, is a well-printed volume of lxxi + 167 pages, to which are prefixed an "advertisement" and a list of subscribers containing numerous titled names with "His Royal Highness the Prince of Wales," who took "six large copies," at their head. The idea of the book was "suggested by a friend, who requested the Author to compose a few elementary lessons on Botany, adapted to Abbé Gaultier's plan of instruction. She intended at first to select a few passages from Dr. Darwin's elegant Poem of the Botanic Garden, and arrange them according to the system of Linnæus; but finding many of the Classes not treated on in that work, and the language frequently too luxuriant for the simplicity of female education, she attempted the following descriptions, in which she endeavoured to imitate the classical distribution and versification of this elegant writer." The author "recommends Martyn's letters on Botany and Lee's Introduction" for the "farther improvement" of her readers, especially for the plates which accompany these works, the excellence of which induced her "to suppress the plates she intended to have added."

The "Preliminary Lessons" begin with a tabular statement: "Botany Treats of Plants: Plants are composed of Root, Stem, Leaves, Props, and Fructification": the "props" include "Stipula, Bractea, Spina, Aculeus, Cirrhus, Glaudula (*sic*), Pilus," each of which is defined, with references to plants exemplifying each. Then come definitions of the classes and orders, with numerous examples; after these follow the "poetical" descriptions, to each of which are appended footnotes giving much useful and well-chosen information about the plants and showing considerable aquaintance with the botanical and other literature of the period. Of the poetical treatment the following, containing as it does references to two persons (Francis Masson and Lady Anne Monson) whose botanical history has been recorded in these pages (see Journ. Bot. 1884–6 for the former and 1918, 347 for the latter), may be cited as an example—it may be remembered that the *Monsonia* was introduced by Masson:—

"Hush, ye rude storms, blow mild, ye western gales,
On the wide sea triumphant beauty sails.
Whence gloomy Afric spreads her sable wings
A glitt'ring gem exploring Masson brings.
From *five strange tribes* a crowd of tawny swains
Sing round the maid their rude untutor'd strains:
Twelve modest virgins near her toilette stand,
And deck her form with Taste's fantastic hand.
'Accept,' he cried, 'this prize, accomplish'd maid,'
As at young Anna's feet the flow'r he laid;
'Sweet emblem of thyself, Oh! let it bloom,
Nor find in Britain's soil an early tomb.'
With timid hand the proffer'd boon she took,
And on its beauty cast a tender look;
'Adopted child,' she said, 'here take thy rest';
And plac'd it gently on her snowy breast.
Her modest blush fell on the op'ning flow'r;
It bow'd its head, and own'd a rival's pow'r,
Received Monsonia's name with flatt'ring pride,
And bloom'd unenvious by bright beauty's side."

The "five strange tribes" of "tawny swains" are, of course, the bundles of stamens; the "simplicity of female education" seems to have required a euphemistic treatment of stamens and pistils: thus *Butomus* (*Enneandria*, *Hexagynia*) has "nine Tritons" and "six young naiads";

"Two simple swains entwine *Glechoma*'s bow'r,"

and are accompanied by "two infant boys"—*i. e.* two long and two short stamens; and so on.

The *Introduction* seems to have had a considerable circulation, as a second edition appeared in 1812 and a third in 1818. This was doubtless owing to the fact, which may also account for the long list of subscribers, that the author occupied an important position at what was evidently a fashionable ladies' school, at 22 (later transferred to no. 33) Hans Place, Sloane Street, Chelsea, at which, among other well-known folk, Lady Bulwer Lytton, Mrs. S. C. Hall, Mary Russell Mitford, and Letitia Elizabeth Landon were educated. From references in the 'Lives' of the two latter, by A. G. L'Estrange and Laman Blanchard respectively, and from T. Crofton Croker's *A Walk from London to Fulham*, we learn that the school (which a note in the *Introduction to Botany*, p. 87, shows was first established at Reading) was "kept by M. St. Quentin (or Quintin), a well-born, well-educated, and well-looking French emigrant," who "had been Secretary to the Comte de Moustiers," and was "one of the last, if not the last, of the ambassadors of Louis Seize to the Court of St. James's. He was assisted, or rather chaperoned, in his undertaking by his wife, a good-natured red-faced Frenchwoman, and by Miss Rowden, an accomplished young lady, the daughter and sister of clergymen, who had been for some years governess in the family of Lord Bessborough, and who superintended the general course of study" (L'Estrange). A long and attractive description of "Fanny Rowden," as she was called, is quoted from Miss Mitford, who for many years visited her old teachers; Laman Blanchard describes Miss Rowden as "herself a poetess and otherwise highly accomplished": she published in 1810 a poem entitled *The Pleasures of Friendship*.

After the death of his wife, M. St. Quentin seems to have resumed his title and returned to France; Blanchard says that Miss Rowden "became Countess St. Quentin and died in the neighbourhood of Paris": this must have been before 1841, the date of the book from which this extract is taken.

REVIEWS.

Lichens. By Annie Lorrain Smith, F.L.S. Demy 8vo, cloth, pp. 464, 135 figs. 55*s.* University Press, Cambridge, 1921.

Both the Cambridge Press and Miss Smith are to be congratulated on the appearance of this the second issue of the Cambridge Botanical Handbook Series commenced before the war: the former in that they have emerged beyond the horizon of the Oxford Press with its bias for the translation of German books, and the latter for the completion of a monumental volume on her special subject which marks the culmination of her previously well-known and standard studies of British Lichens.

The pursuit of Lichenology, although one of the most interesting backwaters of modern botany, has been largely relegated to collectors and systematists; and beyond a casual recognition of phenomena of 'symbiosis,' illustrated by some elementary type, students have little knowledge of the range and beauty of this strangely isolated series of plant-forms, their great importance in the flora of the world as a whole, and the mystery still underlying their origin.

Since the time of Lauder Lindsay's attempt to popularize the study to nature-students of the middle nineteenth century, there has been no convenient introduction to the group in any available language: an abbreviated account by Fünfstück and Zahlbruchner (1898), in the stereotyped style of the *Pflanzenfamilien* of Engler and Prantl, has had to serve for general purposes. Lichenological specialists, again, had retired into a language of their own, the elegance of which may compel admiration for Crombie (*British Lichens*, 1894), but it resulted in few getting beyond the first page.

Miss Smith's work is eminently readable; terminology is simplified, fanciful expressions are largely eliminated, and a useful glossary is placed at the beginning. The lay botanist may perhaps object to the extensive use of the expression 'fruit,' or the rather terrible word 'squamules'; while 'copulation' is certainly a curious term for spermatogamic fusion. The arrangement of the work is exhaustive, including sections dealing with historical aspects, the anatomy and physiology of the symbionts, the general organization of the different types of thallus and their special peculiarities, the mechanism of reproduction, physiology of nutrition, and relation to biological environment, with additional chapters on Bionomics, Phylogeny, Systematy, Ecology, and various Economic Applications—running to over 400 pages of text. In these Miss Smith shows a keenly analytical mind, every section bearing a number or letter, running to paragraphs of the AA, *ee*, order, in a manner reminiscent of the late Professor Marshall Ward, and suggesting that the scaffolding has not been taken down. One would perhaps have liked to see more details on such cytological points as the double reduction in the ascus, or something on Lichenic acids beyond empirical formulæ; critical details of the essential mechanism of fertilization are also left rather vague; but probably the time has not yet come for the weaving of the whole story of the Lichen into a connected whole. The point of importance is that Miss Smith has collected all the materials, and she inspires confidence that there is nothing she has overlooked, even in the case of papers which might well be consigned to oblivion. An introductory note, repeated on the wrapper, rather apologises for burdening the pages with citations; but this is really the strong feature of the book, and gives it its greatest up-to-date value. References in the text are judiciously limited to authors' names and dates in footnotes, and a very complete bibliography at the end covers 24 pages of small type. All the chapters present the same thoughtful review of the material available, and even where Miss Smith has let herself go a little, as in the scheme of polyphyletic progression of the lichen-soma, the inevitable phylogenetic trees are kept within most modest proportions.

The volume, as a whole, constitutes an extremely valuable contribution to British Botany: though necessarily a pioneer volume in many respects, it is practically the first modern scientific work devoted solely to Lichens, and as so will remain a classic; while it may also serve as a model of painstaking compilation for other writers in the series. The few objections that can be taken to it refer to matters beyond the author's control. The get-up of the volume, in the luxurious style of the pre-war issue of West's *Algæ*, has been apparently left to the printer: ample margins, wide spacing, abundant headings—seven different founts of capitals being used for these last—are admirable in their way, but increase expense. The mere list of contents extends to 12 pages, and the Cambridge Chick-Pea adorns the cover. One may admire botanical text-books *de luxe*, but this defeats what should be the primary object of bringing the subject within the range of teachers and students, an impecunious race; at the present time we can only wonder where these are to be found who will be anxious to pay 55*s.* for a book which might have been produced for a sovereign, and is off the main track of the science. The illustrations are also very disappointing; the line-drawings are feeble, and the half-tone blocks, which have necessitated the use of faced paper, are of little value as affording any adequate idea of the wonderful range and beauty of lichen-form; some of them 'might be anything.' Many sections and paragraphs of the book, as dealing with points of ancient history or minor economic applications, would have been better in a smaller type, as tending to differentiate the material really important to the ordinary student. Such minor matters may, however, be referred to the responsible editors of the Cambridge series, to Miss Smith will be accorded the gratitude of the English-speaking botanical world.

A. H. C.

Common Plants. By MacGregor Skene, D.Sc., Lecturer on Plant Physiology, Aberdeen University. 8vo, cloth, pp. 271, 24 plates. London: A. Melrose. 6*s.* net.

It is pleasant to find a popular book about Botany which we can wholeheartedly recommend, and this we have in the volume whose title stands above. It contains a series of thirty-three studies, each "written round a common plant which serves as a particular illustration of plant life." The method of the book is so well defined in the preface that we transcribe it in preference to giving a summary of our own:—

"The studies are not isolated; a number of general themes act as connecting-links. Thus the theme developed in the opening sections is that of nutrition, in relation to the food supply of the world as well as to that of the plant, and this runs through the survey of the vegetable kingdom which follows and occupies the middle part of the book. Grouped round the description of the rise of the land flora are discussions of problems of water supply, of reproduction, of the inter-relations of plants and animals. The relations of the plant to man are emphasised in the opening and closing chapters."

These chapters deal with Wheat, its origin, its photosynthesis, and, finally, its development, in which the application of Mendelian principles has produced important results. The three stages of Parasitism are illustrated in as many chapters by the Mistletoe, the Dodders, and the Broom-rapes; of carnivorous plants the Sundew and Venus's Fly-trap are taken as types, with references to other instances; the White Bryony furnishes the text for a chapter on "the vegetation of plant-movements"; the establishment of *Lupinus nootkatensis* on the shores of the Dee suggests a discussion on "the equipment of a colonist," and the Whin affords an example of "the conquest of barren ground." A welcome feature and one unusual in popular books is the considerable space allotted to algæ, fungi, ferns, mosses, lichens, and bacteria; evidence that the book is up to date is afforded by the fact that Dr. A. H. Church's suggestion that "the land flora came directly from the ocean" finds a place, although not entire acceptance. "The relations between ants and plants," with special reference to the Whin and the Cow-wheat form an interesting chapter; Fertilisation—the Sage and the Hazel; Cleistogamy—the Violet; Seed Dispersal—the Broom—have each a chapter: the Stinging Nettle heads "a study in Weeds"—*Matricaria discoidea* (*suaveolens*), by the way, is by no means confined, even in Scotland, to "east coast fishing villages." *Cytisus Adami*—"Adam's Laburnum"—and other "Grafts, Hybrids, and Plant Chimaeras" bring the book to a close, save for a third chapter on Wheat, to which we have already referred.

It remains to be said that the book is written throughout in a singularly attractive style, with a gratifying absence of technicalities; Dr. Skene must be a delightful lecturer! The illustrations, except those taken from photographs, are somewhat feeble, though they serve to illustrate the text; the book is produced at a reasonable price, which will help to commend it to those of small means.

BOOK-NOTES, NEWS, ETC.

THE *Irish Naturalist* for March contains a notice of Miss MARGARET GREER FLOOD, by Dr. Henry, with whom she had collaborated in his investigations concerning the London Plane and in other papers. Born in Dublin in 1896, she entered Trinity College in 1914, where she had a distinguished career. She more than once obtained first-class honours in Natural Science; and, in October 1918, submitted as part of her research work an investigation on the exudation of water by *Colocasia antiquorum*, which was afterwards published in *The Proceedings of the Royal Dublin Society*. Under Dr. Henry, she carried out research work in Forest Botany at the Royal College of Science in 1918–20, and in the latter year was appointed Technical Assistant in the National Museum. She died in Dublin on May 3, and is buried in the Mount Jerome Cemetery.

THE annual foray and general meeting of the British Mycological Society was held at Worcester on Sept. 19th–24th. The woods of the neighbourhood were worked—Wyre Forest, Monte Wood, Shrawley Wood, and Trench Woods. Owing to the drought, agarics were not abundant, but several interesting species, such as *Strobilomyces strobilaceus*, were found. The dearth of larger fungi led to concentration on micro-forms, and a considerable number of these—including pathogenic species—were listed. About forty-five members of the Society, with members of the Worcester Naturalists' Club took part in the foray and joined in the proceedings. As this was the Society's twenty-fifth anniversary, the President, Mr. Carleton Rea, in his address gave a brief review of its activities and of the work of its members since he sent out his original circular a quarter of a century ago. The other evening proceedings were:—a discussion on

"The Amateur in relation to British Mycology," opened by Dr. E. J. Butler, and papers by Professor A. H. R. Buller and Mr. J. Ramsbottom on "The Chemotaxis of Slugs in relation to Fungi" and "The Origin of Saprophytism in Flowering Plants" respectively. The specimens collected during the meeting were exhibited in the Victoria Institute, which was placed at the disposal of the Society by the Worcester municipal authorities. The programme for 1922 is arranged on similar lines to that of this year, and includes meetings in London for the reading of papers and the exhibition of specimens, and forays for students. The President for 1922 is Mr. F. F. Brooks, of Cambridge.

The recently issued Report of the Botanical Society and Exchange Club of the British Isles contains in a supplement a paper on "The English *Capsella Bursa-pastoris* L." by Dr. Almquist, who has already "published descriptions of 200 constant forms" of the species, and here describes several more. The paper is illustrated, and has an introduction by Dr. Druce. The Report, among other interesting matters, contains a paper on "British Forms of *Centaurea Jacea* L." by Mr. C. E. Britton.

The *Gardeners' Chronicle* for Oct. 15 contains an article by Dr. Henry on the Dublin Arboricultural Society (1831) and an account by Mr. H. J. Elwes of the collection of *Cacti* formed by the late Charles Darrah and presented on his death to the Corporation of Manchester, which built for its accommodation a range of houses in Victoria Park: a catalogue of the 1350 species comprised in the original bequest has been prepared by the curator, Mr. Cobbold.

The *Journal of Indian Botany* for August contains a continuation of the paper by T. S. Sabnis on "The Physiological Anatomy of the Plants of the Indian Desert"; Mr. H. N. Dixon writes on a collection of Mosses from the Kanara District, with descriptions of new species: the editor, Mr. P. F. Fyson, continues his monograph of the Indian species of *Eriocaulon*, illustrated by numerous text-figures and plates.

The contents of *The Journal of Ecology* for September are mainly botanical. They include papers on "The Ecology of *Urtica dioica*" by Carsten Olsen (with plate); "The Durmast Oak Woods of the Silurian and Malvernian Strata near Malvern," by E. J. Salisbury and A. G. Tansley (with plate); "The Effect of Heat on the Transpiration and Growth of Certain Plants," by Kathleen M. Thatcher; "The Ecology of *Calluna vulgaris*, by M. C. Rayer (with plate); "Some Observations on Plants in the Libyan Desert," by H Hamshaw Thomas (with one plate); "Species and Area," by Olof Arrhenius.

Mr. R. W. Butcher informs us that on Sept. 1 he found *Tillæa aquatica* L. on drying mud by a pool at Adel, near Leeds, where it is apparently native. We hope to give further particulars of this interesting find in our next issue.

The *Naturalist* for October contains the first part of a paper by Dr. Salisbury on "The Vegetation of Drying Mud and Retarded Germination as observed in Hertfordshire" and the continuation of Mr. J. A. Wheldon's "Key to the Harpidioid Hypna." The Report of the August Meeting at York of the Yorkshire Naturalists' Union includes notes on the ecology and botany of the district visited.

Manchester Museum Publication (no. 84) is devoted to notes on a collection of Hepatics from the Cameroons, by Mr. W. H. Pearson.

We learn from *Science Progress* (October) that an Indian Botanical Society has been formed, of which Shiv Ram Kashyap, M.Sc., of the Government College, Lahore, is the Secretary-Treasurer. It is not the present intention of the executive to start any publication, but one of the most useful activities contemplated is the establishment of a central exchange for botanical literature and for aiding botanists generally. The promotion of research and the establishment of one or more biological institutes are also part of the official programme. Among the contents of the number are papers by J. S. Huxley on "Some Implications of the Chromosome Theory of Heredity" and by H. Reinheimer on "Symbiosis and the Biology of Food."

The Essex Naturalist (xix. pt. 5: April–Sept.) contains a very complete summary of "Ten Years' Progress in Lichenology in the British Isles"—the address of the President of the Essex Field Club, Mr. Robert Paulson, delivered at the Annual Meeting on April 2; due notice is taken of Dr. A. H. Church's papers lately published in this Journal, and the paper is illustrated by four plates. Under the title "A MS. Essex Florula" Mr. Boulger gives an account of a MS. Flora of Dedham (probably written in 1837) by W. H. Coleman (1816?–1863), one of the authors of the *Flora Hertfordiensis* (1843), which has recently been found and will be deposited in the Department of Botany, British Museum.

From the *Daily Mail*—"Alpine Flowers for Snowdon. A large tract of land on the Llanberis, Carnarvonshire, side of Mount Snowdon has been planted with alpine plants and seeds taken from alpine flowers in Kew Gardens. The Director of Kew, Sir David Prain, with Mr. Walter Irving, a Kew alpine expert, and Mr. T. R. Bulley, recently visited the spot and spent a week-end on the planting. 'The experiment,' said Mr. Bulley, 'is to be continued every year until the greater part of Snowdon is covered with Alpine flowers. It is to be hoped that tourists will help us by not tampering with them.' Chinese rhododendrons are to be planted on the slopes of Snowdon next spring."

We take the following from the *Evening News* of Sept. 15: we have not ourselves seen the notice referred to:—

"Our Erudite Costers.

"The Middlesex County Council has posted notices outside police stations warning costermongers and vendors of plants that after October 1 it will be an offence to sell plants or roots attacked by these diseases or others specified:—

"Eriosoma lanigerum Hausm.
"Nygmia Phoeorrhoea Dan Euproctis chryssorrhoea.
"Leptobyrsa Stephanitis rhododendri Horv.
"Sphoerotheca morsuvae.
"Synchytrium endobioticum."

"JOURNAL OF BOTANY" REPRINTS.

In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

[*Over.*

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THE

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BRITISH AND FOREIGN

EDITED BY

JAMES BRITTEN, K.C.S.G., F.L.S.

LATE SENIOR ASSISTANT, DEPARTMENT OF BOTANY, BRITISH MUSEUM.

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THE POLLINATION OF THE PRIMROSE.

By A. A. Dallman, F.C.S.

(Continued from p. 322.)

2. *Erbistock, Denbighshire.*

Shortly after leaving Cwm, a couple of days (April 29 and 30, 1911) were spent at Erbistock, nearly thirty miles to the south-east—a quiet little village situated in a bend of the Dee and close to the junction of Shropshire, Denbighshire, and Flint (the anomalous detached portion known as Maelor Saesneg): the Dee at this point approximately marks the division between Permian strata (on which Erbistock is situated) and the more extensive Bunter tract to the east. There is a fair amount of woodland along the Dee valley, which is very picturesque hereabouts. The courses of various small tributaries are marked by prominent wooded dingles or nants. These nants, which are quite a feature of this area, afford a congenial habitat for the Primrose, which is also abundant on banks, field-borders, and lane-sides.

On the bank of the road north-west of Erbistock Ferry, which was fairly sheltered with a north-easterly aspect, Primroses were fairly plentiful. A number of flowers on the opposite side also received notice. This stretch (some 4–500 yards) was regularly patrolled at brief intervals from 10 to 1.30 on April 29. The average altitude here was about 240 feet above sea-level; climatic conditions were quite favourable, the night being calm and mild. The visitors to the flowers were as follows:—41 *Limacidæ*, 10 *Rhagonycha fuscicornis* Oliv., 4 *Forficula auricularia* N., 4 *Helix hispida* L., 4 *Oniscus asellus* L., 2 *Otiorhynchus picipes* Fab., 2 *Tachyporus hypnorum* Fab., 1 *Meligethes* sp., 1 *Barynotus obscurus* Fab., 1 *Adrastus limbatus* Fab., 1 *Drymus brunneus* Sahlb.

The slugs may have included more than one species, though *Limax agrestis* was certainly represented. I was much struck by the behaviour of *Rhagonycha fuscicornis*, a distinctive beetle with slender head and thorax which allowed the insect to insinuate itself and feed upon the pollen. Four *Triphæna* larvæ were seen here, but they confined their attention to the foliage. Although various moths were flying about none visited the flowers under observation. Circumstances would not permit of systematic day observations, but I noticed two examples of *Anthophora pilipes* visiting flowers. This early bee, which at first sight looks very like a black *Bombus* of some kind, has a distinctive flight and is a strong and rapid flier. Several flowers were found tenanted by numbers of mites, which Dr. Murray subsequently referred to the genus *Trombidium*. Thrips were seen as usual in abundance.

Another visit was paid to Erbistock in 1913 (March 20–24). I only watched the Primroses on two successive nights (20th and 21st) between 10 and 11, for rather less than two hours in all. These were clear, full moonlight nights, but there had been squalls with rain and sleet during the day, on the 20th, which only abated shortly before

10 on the first night: the flowers were more or less wet, but a number bore evidences of Gastropod or other animal depredations. Both banks of the same road as before were watched, but as flowers were somewhat scattered and not too plentiful, the distance patrolled was extended to about half a mile. The following were seen:—28 *Limacidæ*, 2 Araneids, 1 *Helix hispida*, 1 *Meligethes*.

Some of the slugs were undoubtedly *Limax agrestis* L.

3. *Llanfynydd, Flintshire.*

A few days (April 19–22) were spent here in 1919. The village is situated about eleven miles north-west of Erbistock and some eighteen miles to the south-east of Cwm. It lies on Carboniferous strata; Millstone Grit, Carboniferous Limestone, and Coal Measures are all represented in the area. The valley has an elevation of about 500 feet at this point and is fairly sheltered by the adjoining hills, the lower part of the Clwydian Range to the west and Hope Hills (1080 feet) to the east.

This was a backward season. *Empetrum nigrum* L.—a chief object of this visit—was not in bloom (even by April 22) on a neighbouring peak. In 1918 it was flowering on April 5th.

Primroses were fairly plentiful on banks and hill-slopes in many parts of the district. A sunny hedgebank facing west and at 500 feet elevation on the slope of Hope Hills was chosen. Observations were restricted to about 170 plants, which extended over about fifty yards. I was able to watch these on April 19 and 20 in the daytime (11.30–11.45 and 3.45–4.45)—these and other times mentioned in the Llanfynydd notes are "summer time," the true values being an hour less in each case,—and on both days there was warm sunny weather with only slight breeze. The flowers were visited by 24 *Andrena Gwynana* Kirb., 7 *Hyetodesia lucorum* Fln., 6 *Bombylius major* L., 6 *Lucilia cæsar* L., 1 *Bombus terrestris* L., 1 *Meligethes* sp.

The solitary humble-bee only made a momentary stay on two flowers of a long-styled plant, and did not seriously investigate them, obtaining neither pollen or nectar and rapidly flew off to a neighbouring willow (*Salix caprea*, ♂). The latter attracted large numbers of insects; amongst others visiting the catkins for nectar or pollen were *Apis mellifica* (in abundance, pollen-collecting), *Bombus terrestris*, *Sepsis cynipsea*, *Lucilia cæsar*, and *Hyetodesia lucorum*. Primroses seemed particularly attractive to *Andrena Gwynana*, but it did not restrict itself to these, as I noted that Coltsfoot, Dandelion, Celandine, and Barren Strawberry were also visited. *Bombylius* was also seen on a Celandine flower. While in Nant y Ffrith (April 21) I noticed this in some numbers darting about a sunny bank and hovering in characteristic hawk-like manner; on this latter occasion Primroses often attracted them.

The same bank of flowers which I had watched on April 19, 20 was visited on one night for a short period, 8.45–9.15. The half-hour's watch revealed *Limax agrestis* L., 11 *Tachyporus chrysomelinus* L., *Meligethes exilis* Sturm., *M. viridescens* Fab., *M. erythropus* Gyll., 1 *Porcellio scaber* Latr., 1 Araneid.

Several slugs were at work on the flowers and I had previously noticed, in the daytime, that 33 out of the 170 or so plants had blossoms showing the results of Gasteropod or other visitors.

SUSSEX.

Tile Hurst Wood (largely Oak), where most of the Sussex observations were made, lies about nine miles inland (north) of Beachy Head and one mile north-west of Hailsham. This is on the Weald Clay, and the two situations to which these notes relate—the north-east and south-western portions of the wood—have an average elevation of about 60 feet. The South Downs lie some three or four miles away on the south and south-west, while a considerable alluvial expanse of marshland, the Pevensey Levels, extends for some distance to the east and south-east. These Levels now "form an extensive flat, scarcely raised above the sea-level, intersected in all directions with dikes and ditches extending for nearly seven miles along the shore of Pevensey Bay, and running for about six miles inland" (Roper, *Flora of Eastbourne*, 1875). The little Cuckmere river flows close to the wood on the north-west, while to the north there is an expanse of upland country of Greensand formation which is pleasantly wooded in many parts.

Observations extending over fifteen hours were made on various occasions between 11.30 and 8 on seven days between May 4–13, 1911. These were under rather unfavourable conditions, as the flowers were on the wane, the season being well advanced and the weather was largely unpropitious. Cold east winds prevailed during ten hours of the fifteen, and, though sunny for about ten, there were only about five hours of warm sunshine accompanied by calm. The following were observed visiting the flowers here:—*Bombylius major* L., 1 *Bombus hortorum* L., *Anthophora pilipes* Fab., 2 *Halictus leucopus* Kirb., *Epuræa longula* Er., *Meligethes difficilis* Sturm., *M. flavipes* Sturm., *M. maurus* Sturm., *M. picipes* Sturm., *Tachyporus solutus* Er., 2 Araneida.

Bombylius was a not uncommon visitor; examples were seen each time the flowers were watched during bright sunshine. *Bombus hortorum* was sucking nectar (May 9) while the two examples of *Halictus leucopus* ♀—captured in Miss Bray's garden—were investigating the mouth of the corolla-tube. The latter may have been seeking pollen, as its tongue is much too short to permit of access to the nectar. The various Coleoptera appeared to be not uncommon, but statistics as to their relative frequency were not obtained. During three hours' watching (11.30–2.30) on May 7 it was observed that, though many bees of various types were about, they avoided the Primrose. It should not be forgotton that this was near the close of the Primrose season, and the competing claims of other plants must not be overlooked. Thrips commonly infested the flowers.

Nine visits were made to the same place in 1912; the flowers were watched between 12.15 and 5.0 for about twenty-five hours, between March 16 and April 27. South-westerly winds prevailed during a considerable portion of the time, which, on the whole, was warm and sunny. The general conditions were much more favourable than in

1911, and the following visitors were observed :—*Bombylius discolor* Mik., *B. major* L., *Anthophora pilipes* Fab., *Gonepteryx rhamni* L., *Meligethes picipes* Sturm., *M. difficilis* Sturm., *Meta segmentata* Clk.

I have not included a pollen-collecting bee which visited the flowers on April 7th, as no specimen was sent; it may have been *Andrena Gwynana.* There were relatively few insects flying about for the first fortnight or so, during which period the flowers seemed to be chiefly visited by *Thrips* and small Coleoptera (*Meligethes*). The warmer and sunnier conditions in April caused a rapid increase of insect life, and many *Bombylii* and occasional "Humble-Bees"—the term is here used in a wide sense, as Miss Bray did not discriminate between bees of the genera *Anthophora* and *Bombus*, several specimens sent were *pilipes*—came to the Primroses. Only one example of *Gonepteryx rhamni* was seen taking nectar on April 20—a very warm day with bright sunshine. Miss Bray writes, "I was much impressed with the frequency of the visits of *Bombylius* beyond the visits of other winged creatures. *Bombylii* are much more frequent visitors than humble-bees, for while the latter commonly favour other flowers, the former visit the Primrose almost exclusively." On April 6, a very favourable day, observations were made (12.45–5.0 P.M.) on a practically dry pond-bed in Tile Hurst Wood. There was a wealth of Primrose bloom, and an abundance of *Cardamine pratensis* was interspersed with them. Numerous *Bombylii* frequented the Primroses, while humble-bees made occasional visits. Hive-bees were plentiful, and swarmed on the flowers of *Cardamine*, while they ignored those of *Primula*.

The following is a systematic list of various visitors to the flowers of the Primrose, based on the foregoing observations in North Wales and Sussex:—

ARACHNIDIA. *Trombidium* sp., Araneida (not identified), *Meta segmentata* Clk.

COLEOPTERA. *Adrastus limbatus* Fab., *Barynotus obscurus* Fab., *Epuræa longula* Er., *Meligethes difficilis* Sturm., *M. erythropus* Gyll., *M. exilis* Sturm., *M. flavipes* Sturm., *M. maurus* Sturm., *M. picipes* Sturm., *M. viridescens* Fab., *M.* sp., *Otiorhynchus ligneus* Oliv., *O. picipes* Fab., *Rhagonycha fuscicornis* Oliv., *Sciaphilus muricatus* Fab., *Tachyporus chrysomelinus* L., *T. hypnorum* Fab., *T. solutus* Er.

DIPTERA. *Bombylius discolor* Mik., *B. major* L., *Hyetodesia lucorum* Fln., *Lucilia Cæsar* L.

GASTROPODA. *Helix hispida* L., *H.* sp., *Limax agrestis* L.

HEMIPTERA. *Drymus brunneus* Sahlb.

HYMENOPTERA. *Andrena Gwynana* Kirb., *Anthophora pilipes* Fab., *Bombus hortorum* L., *B. terrestris* L., *B.* sp., *Halictus leucopus* Kirb.

ISOPODA. *Oniscus asellus* Linn., *Porcellio scaber* Latr.

LEPIDOPTERA. *Gonepteryx rhamni* L.

ORTHOPTERA. *Forficula auricularia* N., *Thrips* sp.

The various Arachnida can hardly be regarded as of importance as pollinating agents, though the mites (*Trombidium*) which infested several flowers at Erbistock on one occasion would be as effective as *Thrips* in aiding self-pollination. Spiders have been seen on several occasions in different localities waiting on the flowers for victims. Burkill (*l. c.*) has recorded the similar habit of an Araneid (*Xysticus pini*), which he observed lurking on the capitula of Coltsfoot and Daisy, where pollination could certainly be brought about by such an agent. In the case of the Primrose, old spiders may now and again aid as pollen-distributors to a limited extent, and may occasionally assist in autogamy of the short-styled flowers. Coleoptera are regular visitors, feeding upon the pollen and petals. Some eighteen species have been observed, most of which were previously unrecorded. This is doubtless due to the fact that the observations of previous writers were confined to the daytime, while many beetles are characterised by nocturnal activities. From what I have seen of their habits and structure I have no doubt that such Coleoptera are often of value in bringing about pollination.

There can be no doubt that the handsome bee-like *Bombylii* are of considerable importance in pollinating the Primrose: the observations in North Wales and Sussex fully confirm those of Briggs and Weiss in South Devon and Shropshire as to the frequency of such visitors. These flies are entirely anthophilous and suctorial, with long, projecting, conspicuous probosces, which are excellently adapted for probing such a tubular flower as the Primrose. *Bombylius major* has a proboscis of 10 mm. in length; in the case of the other Primrose-haunting species (*B. discolor*) it is rather longer (11–12 mm.): *B. major* appears to be the more common. On visiting a Primrose, the fly pushes its hairy head into the aperture as far as possible, so that it is able to secure nectar at a depth which may be more than the length of its proboscis would suggest. It is quite probable that in some of the larger flowers the nectar may be out of reach, though it does not follow that *Bombylii* would avoid them on this account, as H. Müller (*Fertilisation of Flowers*, p. 43) has shown that the proboscis is provided with effective piercing structures which can easily penetrate soft tissues. He has often seen them insert their proboscides into various nectarless flowers; in such cases he supposes that the boring apparatus was being employed. Whether *Bombylius* evinces any discrimination or not as regards Primroses with longer corolla-tubes than usual I cannot say; but it has a characteristic habit of hovering while apparently selecting particular blossoms before alighting. It seems strange that Darwin and other observers should have failed to detect these important pollinating agents at work. On the other hand, *Bombylii* are essentially sun-lovers and comparatively inactive in the absence of sunshine or in cold exposed situations. Although our knowledge as to the distribution of Diptera in Britain is very scanty, it would appear (Verrall, *British Flies*, v. 496–9; 1909) that *B. major* and *B. discolor* are not uncommon in the southern half of England, the latter being specially noted for Sussex where it occurs in "all large woods and even open roadsides." *B. major* would seem to have a wider range, as it has been seen in the south of Scotland.

The following remarks by J. G. Wood (*Insects at Home*, p. 616; 1872) are of interest; they seem to have escaped the attention of botanical writers, no doubt owing to their appearance in an entomomological work:—"A warm spring day is the time in which the Humble-Bee Fly may generally be seen. . . . . Whenever I wanted to catch a *Bombylius* I used to look out for a patch of Primroses on which the sun was shining, and to wait there with the net placed close to the flowers in readiness for a stroke. After waiting some little time, and taking care not to make the slightest movement, a *Bombylius* was nearly sure to come to the flower, and hover first over one and then over another as if to ascertain which blossom contained the most honey. Having at last fixed upon a flower it would plunge its proboscis into it and then a quick stroke of the net would secure it."

It has not, I believe, previously been remarked that the time during which *B. major* and *B. discolor* are in evidence coincides to a remarkable degree with the flowering period of the Primrose: both are early vernal insects, disappearing by the end of May. Verrall (*op. cit.*) gives March 15 to May 17 as the period of *B. discolor*, while the commoner species ranges from March 27 to May 27. It may be added that the two remaining British *Bombylia* are summer insects, and do not emerge until the Primrose season is past. *Lucilia cæsar* and *Hyetodesia lucorum*, which were noted as visitors at Llanfynydd, did not visit the flowers in the systematic manner of *Bombylius*. Sometimes they fed on pollen of short-styled flowers, while at other times they seemed to regard Primroses as convenient resting-places on which to bask. The nectar was, of course, inaccessible to these, though they may be occasional agents in pollination.

Owing to lack of previous night observations, Gasteropoda have not been hitherto recorded as Primrose visitors, but nocturnal watching shows that they are not infrequent. The flattened corolla-limb and the slightly projecting stigma or stamens are features conducive to pollination by snails or slugs. It is not uncommon to find these creatures crawling over the corolla at night time and feeding on the floral organs, when the head and the slimy surface of the foot commonly come into contact with the stamens or stigma, as the case may be, in the mouth of the corolla. When the animal is on a short-styled plant, pollen-grains commonly adhere to it, and these may be transferred to stigmas of adjoining long-styled plants. Transference of pollen from long-styled to short-styled flowers may also occur, but I think effective pollination in this way is unlikely. On the other hand, snails and slugs may readily contribute towards autogamy in the case of short-styled flowers.

Knuth (*l. c.*) only mentions three European plants (*Calla palustris*, *Chrysosplenium alternifolium*, and *Chrysanthemum Leucanthemum*) for which snails or slugs have been recorded as pollinating agents. Ludwig (Sitz-Bericht Gesellsch. Nat. Freunde, 1889, p. 17) observed numerous slugs (*Limax lævis* Müll.) on the capitula of *C. Leucanthemum*, where he states that they greedily devoured the white ray florets. The latter considered that slugs may in wet seasons, when usual pollinating agents are commonly inactive, be effective substitutes for insects which are only of use in dry weather. The evidence obtained regarding the visits of snails and slugs and their behaviour in connection with Primrose flowers shows that it is to some extent malacophilous. The Hemipteron (*Drymus brunneus*), seen only on one occasion, must be classed as a casual and unusual visitor. Mr. E. A. Butler, to whom I am indebted for the identification, states that it would be an over-wintered example.

The Sussex and North Wales observations, in conjunction, clearly indicate that the flowers are visited by bees to a considerable extent. *Andrena Gwynana* appears to be as important a visitor in North Wales as Weiss has shown it to be in Shropshire; here too it was actively engaged in collecting pollen, as the nectar was of course out of reach: this could readily accomplish pollination, especially in the long-styled flowers. As might be expected, at this season the insects in evidence were mainly queens. Six examples which were captured were queens, but one taken on a neighbouring Dandelion proved to be a male. It seems strange that this bee was not noticed at Tile Hurst Wood in connection with the Sussex observations of 1911–12.

The nectar is easily accessible to *Anthophora pilipes*, with a proboscis of 19–21 mm. long; and this bee is undoubtedly an efficient pollinating agent in both types of flower. Miss Bray noticed it as an occasional visitor to Primrose in Sussex; it has been seen by me on them in North Wales, while I have often observed it on Cowslips at Cwm, and on Primroses in Wirral, Cheshire (1919). In view of its behaviour elsewhere, I have no doubt that extended observation would reveal further evidence of this solitary bee as a visitor to the Primrose in North Wales. The true Humble-Bees are only erratic visitors and do not devote much attention to Primroses. The nectar is only accessible to the queen *Bombus hortorum*, whose proboscis has a length of 19–21 mm., while that of the queen *B. terrestris* is only about half as long. Although both species could easily collect Primrose pollen, they show a distinct preference for other flowers. As Bell (*l. c.*) has observed, the more numerous worker Humble-Bees do not appear until later, when the Primrose season is usually past. While *Bombi* are quite capable of pollinating the Primrose, and occasionally do so, they cannot be regarded in North Wales as serious agents. Scott Elliot (*l. c.*) records *B. hortorum* as a regular visitor to Primroses in Dumfriesshire, but this is not the case in North Wales.

The occurrence of *Oniscus asellus* and *Porcellio scaber* as nocturnal visitors to Primrose flowers is of interest, as Isopoda have not been hitherto regarded as agents in pollination. As they appear to feed on the flowers, they may bring about autogamy in the short-styled form or cross-pollination in the other type. The nocturnal habits of the earwig have hitherto enabled it to evade detection as a Primrose visitor; it seems to be not uncommon at night time, when it feeds on the flowers, and its behaviour shows that it may assist in pollination.

Gonepteryx rhamni was seen on a single occasion in Sussex, and although other observers have recorded it on Primrose flowers, which it can readily pollinate, in the south of England, it cannot be regarded as a common visitor, though frequent in Sussex. It rarely occurs in North Wales, and is thus of no importance in regard to the pollination of Primroses in Wales.

Summary.

The conflicting views of various writers in regard to the pollination of the Primrose may be to some extent due to the fact that the influence of climatic conditions has not always been taken into account. No one who has carefully studied flowers and their pollination in the field can fail to be convinced of the necessity of calm, warm, and sunny weather, if such investigations are to be of value. This is especially true in the case of animal-pollinated species, as Sprengel (*Das entdeckte Geheimnis der Natur*, p. 23; 1793) long ago pointed out; Müller (*Die Alpenblumen*, p. 547; 1881) has also emphasised its extreme importance, and Weiss (*l. c.*) has also called attention to the fact. The absence of any previous systematic nocturnal observation has also contributed to the uncertainty, as night-watching in North Wales has resulted in a considerable addition to the visitors previously recorded. The investigations recorded above, extending over several seasons, have practically doubled the list of visitors hitherto recorded for the Primrose. Cold winds, wet weather, and low temperatures are also found to exercise an adverse influence on nocturnal visitors. Night-observations in Flint and Denbigh negative the statement of Darwin quoted above "that the pollination of the Primrose . . . . . must depend almost exclusively on moths." I have failed to detect a single moth as a visitor, and conclude that nocturnal Lepidoptera may be ruled out of account. Bell (*op. cit.* pp. 32–3) has remarked on the scarcity of night-moths at the season when the Primrose is usually in bloom.

Moths only appear to have been observed (Knuth, *op. cit.*) as floral visitors to a single member of the genus, *Primula longiflora* All., a handsome Continental species. This, however, has variegated pink flowers which are not adapted to nocturnal lepidoptera, but are visited by the diurnal, *Macroglossa stellatarum*. Darwin may have had this fact in mind when endeavouring to account for the efficient pollination of the Primrose, which was necessary to substantiate his interpretation of heterostyly. Typical moth-flowers, as Sprengel (*l. c.* p. 16) pointed out, are devoid of nectar guides. Although the colour and the narrow tubular nectariferous corolla are to some extent suggestive, the variegation and the comparative absence of odour do not favour moth-pollination in the Primrose.

The chief diurnal visitors which regularly visit the flowers under favourable climatic conditions are the Diptera *Bombylius major* and (in Southern England) *B. discolor*, the bees *Andrena Gwynana* and *Anthophora pilipes*, and Coleoptera of the genus *Meligethes*. The humble-bees—*Bombus hortorum* and *B. terrestris*,—and other animals which are less frequently associated with the flowers or show little structural adaptation to this end, can only be regarded as occasional or subsidiary agents in the pollination of the Primrose. Pollination may also occur at night time through the agency of Gasteropoda (snails and slugs), earwigs, certain Coleoptera (especially *Otiorhynchus*, *Tachyporus*, and *Rhagonycha fuscicornis* O.), and the Isopoda

Oniscus asellus and *Porcellio scaber* which feed on the flowers. Gibson (Trans. Bot. Soc. Ed. xix. 155) notes that the Primrose occasionally fruits on the island of St. Kilda, where bees and Lepidoptera are absent, and suggests that this may be due to pollination by Diptera. While this is possible it may also be the result of autogamy. Bell and Weiss have suggested that self-pollination is probably of frequent occurrence in the Primrose, and I am of the same opinion, but experimental work is needed here. I have observed it fruiting plentifully at Cwm and elsewhere in North Wales.

The flowers show considerable adaptation to zoophily, and this also finds reflection in the many types of visitor which may be attracted and are capable in varying degree of effecting pollination.

NOTES ON NOMENCLATURE.

By T. A. Sprague, B.Sc., F.L.S.

1. Four Overlooked Generic Names.

Mr. N. E. Brown has drawn attention to some generic names which appeared in Haworth's *Revisiones Plantarum Succulentarum* (1821), but have hitherto been overlooked (Gard. Chron., Sept. 3, 1921 *et seq.*). Haworth's *Revisiones* included a new account of *Mesembryanthemum* comprising 310 species arranged in 69 sections and 8 groups of higher rank. He had hoped to divide *Mesembryanthemum* into several genera, but found this to be impracticable, as is evident from his introductory remarks (*op. cit.* 79). Haworth, however, formally proposed two new segregate genera, *Glottiphyllum* and *Gibbæum*, although in his enumeration he retained in *Mesembryanthemum* the sections on which they were based. He also suggested that if the groups *Minima* and *Cephalophylla* should prove to be distinct genera, they should receive the names *Conophyton* and *Cephalophyllum* respectively. Hs cited the pre-Linnean name *Nycterianthemum* as a synonym with sect. *Noctiflora*, which he thought might possibly prove to be a separate genus. These five names were not included in the *Index Kewensis.* Dalle Torre and Harms cite *Nycterianthemum* as a synonym of *Mesembryanthemum*, but do not mention the others. The synonymy of the four names proposed or suggested by Haworth is as follows:—

Glottiphyllum Haw. Rev. 103 (1821), in obs.—*Mesembryanthemum* sect. *Linguæformia* Haw. Syn. 219 (1812); sect. *Linguæformia*, *Cruciata* et *Difformia* Haw. Rev. 93, 100, 101.

This generic name was proposed in a remark at the end of the enumeration of the *Difformia* : "Obs. *Linguæformia* bonum genus constituunt, et nomen *Glottiphyllum* propono." It may be associated with the description given in the *Synopsis*, and is nomenclaturally valid according to the International Rules. The section *Linguæformia* of the *Synopsis* was divided into the subsections *Disticha* and *Cruciata* ; these became the sections *Linguæformia* (sensu restricto) and *Cruciata* of the *Revisiones*, except that three species were separated as a third section, *Difformia*. It is evident, from the position of Haworth's remark, that *Glottiphyllum* was equivalent to *Linguæformia* as defined in his *Synopsis*. This suggests that the remark may have been written before his MS. was finally revised for publication.

GIBBÆUM Haw. Rev. 104 (1821), in obs.—*Mesembryanthemum* sect. *Gibbosa* Haw. *l. c.*

Appended to the description of the section *Gibbosa* is the observation: "Genus bonum, et *Gibbæum* nomen propono." The publication of the name is valid according to the Rules.

CONOPHYTON Haw. Rev. 82 (1821), in obs.—*Mesembryanthemum* sect. *Minima* Haw. *l. c.*

The description of sect. *Minima* was followed by the remark "If this section proves to be a genus, the name *Conophyton* would be apt." This is no more than a suggestion that in certain hypothetical circumstances *Conophyton* would be a suitable name, and does not constitute valid publication under the International Rules. Haworth did not assume the responsibility of raising the section *Minima* to generic rank: he merely suggested the possibility that it might be so raised in the future.

CEPHALOPHYLLUM Haw. Rev. 108 (1821), in obs.—*Mesembryanthemum* group *Cephalophylla* Haw. *l. c.*

The group *Cephalophylla* included two sections, *Corniculata* and *Capitata*. Appended to the description is the remark: "Genus si bonum, nomen *Cephalophyllum* propono. Forte duo genera." Haworth had not decided whether *Cephalophyllum* should be separated from *Mesembryanthemum* nor, if it were separated, whether it should be treated as a single genus or two genera. In the circumstances the publication of the generic name *Cephalophyllum* cannot be considered as valid. As Haworth did not accept the responsibility of separating *Cephalophyllum* generically, his proposal that it should bear that name if it were eventually separated is no more than a suggestion which, as far as the International Rules are concerned, might be adopted or rejected by the first author who actually raised the group to generic rank. The name *Cephalophyllum* referred to the capitately crowded leaves and would have been restricted by Haworth to the section *Capitata* had he created two new genera.

The pre-Linnean name *Nycterianthemum* was mentioned by Haworth as synonymous with sect. *Noctiflora* in a remark at the end of his description of that section: "Genus proprium? Antiquorum Botanicorum *Nycterianthemum*." This amounts to publication in synonymy, which is invalid. He did not even suggest that the name should be adopted.

He also mentioned the sections *Bracteata* (l. c. 143) and *Calyculata* (l. c. 165) as representing separate genera, and the *Pomeridiana* (l. c. 162) and *Juncea* (l. c. 175) as possibly distinct genera, but suggested no names in these cases.

It has seemed worth while to discuss the validity of the above names, as the interpretation of the International Rules is involved. Though it is not explicitly stated in the Rules that an author who proposes a name for a suggested new group must himself adopt the group in question, it is surely implied. Otherwise there would be nothing to prevent botanists of a certain type from bestowing generic names in anticipation on a wholesale scale. They could write, for example: "In the event of the 30 sections of *Garcinia* being regarded as genera, I propose the following generic names for such as have not already received them," without assuming the slightest responsibility for the validity of the proposed new groups. The recognition of the validity of such "conditional" proposal of names would tend to increase the mass of synonymy with which systematic botany is encumbered.

2. The Orthography of some Generic and Specific Names.

The Vienna Code recommends that generic names derived from names of persons should be formed as follows: (*a*) when the name ends in a vowel, the letter *a* is added, except where the name already ends in *a*, in which case *ea* is added; (*b*) when the name ends in a consonant, the letters *ia* are added, except where the name ends in *er*, in which case *a* is added (Rec. IV.). Names contrary to a recommendation, however, cannot be rejected (Art. 2), and the original spelling of a name must be retained, except in the case of a typographic or orthographic error (Art. 57).

The method recommended for the formation of generic names is artificial, being contrary to the etymological history of the Romance languages. Five considerations may, however, be urged in its favour: (1) that it is easily applied, requiring no linguistic knowledge; (2) that the names of the persons commemorated are altered as little as possible; (3) that several cognate names in different languages can be commemorated, e. g. *Carpentaria*, *Carpenteria*, and *Charpentiera*; *Ferraria*, *Ferreirea*, and *Herreria*; (4) that it is applicable to names not of Romance origin; (5) that it has been generally adopted.

At the beginning of the eighteenth century, however, when Latin was more in use as a means of communication between scientific men, an attempt was often made to latinize personal names on etymological principles. Thus Tournefort used the Latin form Plumerius for Plumier, and commemorated him in the genus *Plumeria* (Inst. ed. 3, i. 659; 1719); and Kalm dedicated the genus *Gaultheria* to Gaulthier (Linn. Diss. Nov. Pl. Gen. 20, n. 1080; 1751). This was in accordance with the well-known rule that French substantives and adjectives ending in *-ier* and *-ière* are commonly derived from Latin words in *-ari-* or *-eri-*, as illustrated by the following examples: denarius, denier; januarius, janvier; carpentarius, charpentier; mortarium, mortier; primarius, premier (the doublet primaire is a "learned" word introduced through books at a later period); ministerium, métier (*cf.* Diez, Etym. Wörterb. Roman. Sprachen, ed. 3, 275; 1869); cœmeterium, cimetière; heri, hier. The name Plumier was doubtless derived from plumarius, but the convention adopted by Tournefort and others was to latinize all such names by converting *-ier* or *-ière* into *-erius*. Thus Perraudière became Perralderius (cf.

Perralderia and *Epimedium Perralderianum*), and Olivier was latinized as Oliverius (cf. *Oliveria*).

The generic names *Plumeria*, *Gaultheria*, *Perralderia*, *Oliveria* are not formed in accordance with the particular convention recommended in the Vienna Code, but they contain no typographic or orthographic errors, and should therefore be preserved unchanged in spite of the fact that they have been modified to *Plumiera* (by Linnæus, who afterwards adopted the spelling *Plumeria*), *Gaulthiera* (by Reichenbach), and *Oliviera* (by D. Dietrich).

The rubiaceous genus *Valantia* affords a parallel instance. Tournefort dedicated it to Vaillant, whose name he latinized as Valantius. Strictly speaking, Valentia would have been the correct Latin form, but Tournefort chose *Valantia* as being a nearer approximation to Vaillant. Gleditsch altered the spelling to *Vaillantia* in 1751, but in 1764 (Syst. 163, n. 664) accepted the form *Valantia*, which had been adopted by Linnæus. According to the Vienna Code the alteration of *Valantia* to *Vaillantia* is unwarranted.

Names of Greek origin in which an aspirate has been omitted present more difficulty. In the cases of Greek words commencing with ῥ it is perhaps desirable to insert the *h*, where it has been omitted: thus *Rynchospora*, *Ryssopterys*, and *Rytidophyllum* have been altered to *Rhynchospora*, *Rhyssopteryx*, and *Rhytidophyllum* respectively (*vide* Dalle Torre et Harms, Gen. Siphonog. nn. 492, 4222, 7892).

Names incorrectly formed from Greek words commencing with ἑ or ἡ are especially troublesome. If *Eleocharis* is to be altered to *Heleocharis*, as recommended by Dalle Torre and Harms, surely *Elodea* should become *Helodea*, as proposed by Reichenbach in 1841 and adopted by Ascherson and Graebner in 1897, and *Hypericum Elodes* should be *H. Helodes*, as suggested by Saint-Lager in 1880. The correction of all badly-formed generic names would lead, however, to some curious results: thus if Wittstein (Handwörterb. ed. 2, 314, 422; 1856) was right in deriving *Edosmia* Nutt and *Hedeoma* Pers. from ἡδυς and ὀσμη, the correct forms of these generic names would be *Hedyosmia* and *Hedyosma*, respectively, which would be liable to be confused with each other and with *Hedyosmum* Sw.

The degree to which orthographic correction should be carried is left in the Vienna Code to the discretion of the individual botanist (Art. 57 and Rec. XXX.). The result is that botanists who attach importance to linguistic purity will introduce or accept orthographic changes which will be rejected by others who have regard solely to convenience. It is a choice of two evils: whether to retain a badly-formed name, or to correct it and thus alter its position in an index; in the latter case it is apt to be overlooked until the change has become familiar. Questions of this kind might usefully be referred to a small international committee which should publish a report on them prior to the next International Botanical Congress.

A convention which is observed by some botanists is to replace an initial *i* by *j* whenever it is followed by a vowel. Thus Dalle Torre and Harms changed *Iödes* Blume into *Jodes*; they attributed the spelling *Joedes* to Blume, having mistaken the sign of diæresis for an umlaut. In a similar way they altered *Iantha, Iochroma, Ione, Ionidium, Ionopsis*, and similar names by substituting a *j* for the initial *i*. The idea underlying the change was apparently to indicate that the letter has the value of a consonant, but P. W. Myles, who was an authority on classical pronunciation, stated that the initial *i* in such cases formed a separate syllable (Nicholson, Dict. Gard. iv. 307, 308).

As the result of the change, Dalle Torre and Harms merged all genera commencing with *i* or *j* in one alphabetical series in their index, which is not very convenient. The list of Nomina conservanda recognized by the Vienna and Brussels Congresses was arranged in accordance with the *Genera Siphonogamarum*, and adopted the same spelling. It does not appear, however, that the change from *i* to *j* was actually sanctioned by either Congress, and it seems desirable that the question should be decided at an early date.

Typographic or orthographic errors have occurred in the following cases, and require to be corrected. *Quercus castanopsisifolia* Hayata should become *Q. castanopseifolia*, but *castanopseophylla* would have been better. *Gluta benghas* Linn. should be *G. renghas*, as the vernacular name of the tree is rengas, and benghas is meaningless. *Dombeya mupangæ* K. Schum. was collected by Kirk at Shupanga, and should become *D. shupangæ*. *Dracæna brachystachys* Hook. f. is a typographical error for *D. trachystachys*, owing to an uncrossed *t* having been mistaken for a *b*. Hooker described the species "from one leaf and a portion of a panicle," and stated that the panicle was apparently *very large*, with *scaberulous* branches. Similarly *Globba brachycarpa* Baker is a typographical error for *G. trachycarpa*, and *Hetæria alba* Ridl., which is a *tall plant* with *yellow flowers*, should be *H. alta*. For the last three examples I am indebted to Mr. H. N. Ridley.

CRITICAL NOTES ON SOME SPECIES OF *CERASTIUM*.

By Frederic N. Williams, F.L.S.

(Continued from p. 329.)

140. C. grande Greene in Pittonia, ii. 229 (22 July, 1892):—"Stems simple, with few and long internodes, 1–2 ft., from slender rootstocks, bright green, hirsute-pubescent; leaves linear, acuminate, $1\frac{1}{2}$–3 in., 1–3 lines broad. Fl. 1–5, erect, short-peduncled at summit of stem. Sepals oblong-lanceolate, scarious at the margin, finely striate-nerved, 3–4 lines long. Corolla 1 in. broad, the petals with a sharply triangular notch at the summit. Capsule straight, $\frac{3}{4}$–1 in., the teeth short and circinate-revolute."

Hab. Porcupine river, in E. Alaska, within the Arctic circle (*J. H. Turner*, 1891).

This agrees exactly with the description of *C. maximum* Linn. as given by Fenzl in Ledebour, Fl. Rossica, i. 399 (1842), and as figured in Gmelin, Fl. Sibirica, iv. 148, t. 69, f. 1 (1769), and Ledebour, Ic. pl. fl. Rossic. illustr. v. t. 424 (1834).

141. C. GRANDIFLORUM D. Don, Prodr. fl. Nepal. 216 (1825):—"Hirsutum; foliis inferioribus spathulatis; superioribus lanceolatis acutis; fl. terminalibus glomeratis, calycibus acutis pistillisque corollâ brevioribus; caule decumbente ramoso."

Hab. Narainhetty, in Nepal (*Hamilton*, 1803). I can find no such name in Hunter's *Gazetteer of India*, vol. vii., nor in any recent map of Nepal.

Syn.—*C. vulgatum* var. *grandiflorum* Hooker f. Fl. Brit. Ind. i. 228 (Jan. 1874); *C. napalense* Wall. List [n. 628] ex Hooker f.

For this distinct variety I propose the new name of *C. glomeratum* var. *nepalense.* The brief description which follows (characters which deviate from typical *C. glomeratum*) is based upon examination of the following specimens in Herb. Kew.:—"*C. napalense*, Wall. n. 628" (Nepal, 1821); a sheet labelled "*C. triviale* var. *napalense*," with three specimens—"*C. napalense* var. *elongatum*" (Wallich, 1829), "*C. napalense* var. *ovalifolium*," and "*C. glomeratum* var. *floridum*,"; "*C. glomeratum*, Kashmir (Royle, 1832); *C. triviale* var. *nepalense*," Kendrum, in Sikkim Himalaya, at 2100 metres (ex coll. Hooker); "*C. vulgatum* var. *nepalense*," valley of the Indus at 300 metres (S. Thomson); "*C. vulgatum* var. *grandiflorum*," Pir Pungul in Kashmir, at 3300 metres (Levinge, 1877, comm. C. B. Clarke, sub n. 27150). With these I have examined and compared the original type-specimen in Herb. Mus. Brit., dated 11 March, 1803, on which the locality is spelled "Naramhetty." It is obviously an annual plant, with stems of 25 ctim., and the lower leaves 17–20 mm., and with the characteristic "glomerate" flowers. There is also another specimen by a later collector labelled "*C. vulgatum* var. *grandiflora*."

C. glomeratum var. *nepalense* nobis.—Caules 1½–2½ dem., decumbentes ramosi, debiles et flaccidi. Folia inferiora 16–20 mm., superiora acuta. Pedicelli abbreviati tenues. Sepala 6 mm. Petala 12 mm., biloba. Capsula matura 10 mm. Semina ferruginea.

Hab. Temperate Himalaya, from Kashmir to Sikkim, at 1800–3500 metres.

142. C. GRANDIFLORUM Gilib. Fl. Lithuanica, fasc. v. 159 (1782); et Exercit. Phytol. i. 299 (1792); et ex Ledeb., Fl. Rossica, i. 412.—Gilibert's description is as follows:—"Caules plurimi geniculati semiprostrati cespitosi. Folia linearia ligulati. Pedunculi uniflori: flores erecti subumbellati; calyx subhirsutus; petala calyce duplo longiora, ad unguem bifida, lineata tenera; capsula ovato-acuminata curvata." He says that it is nearest *C. arvense.* I do not see in what way it deviates from the common form, of which it seems to be a state with weaker stems, somewhat narrower leaves, and larger flowers. As Willkomm rightly says—"attamen varietates constantes vix distingui possunt: in stationibus subalpinis et alpinis plusminus condensata, pauci- et grandiflora evadit."

143. C. GRANDIFLORUM Pourret herb. ex Willk. & Lge. Prodr. fl. Hisp. iii. 636; =*C. gibraltaricum* Boiss.

144. C. GRANDIFLORUM Waldst. et Kit., Pl. rar. Hung. ii. 183, t. 168 (1805).—Originally described and figured from specimens from

the Alps of Croatia, *e.g.* near Viszocsicza, Badany, and Szegestan. Recorded from Styria, in Austria, eastward to Trans-Caucasia.

As supplementary to the ordinary description, the following note, ex Gay MSS. attached to a specimen in Herb. Kew., is from his observations on the living plant (dated 28 May, 1843):—"Pubes intricata, crispata. Radix perennis. Bracteæ ex toto scariosæ, omnes, etiam inferiores. Sepala ovato-oblonga obtusa margine late scariosa. Petala calyce triplo longiora, limbo bilobo, ungue glaberrimo. Filamenta 10, omnia glaberrima, 5 petalis opposita, cæteris breviora, 5 longiora basi glanduloso-incrassata, glandulâ flavâ. Ovarium 10-fariam infra medium pilosum."

The plant occurs under five forms in Yugo-Slavia. These have been mostly differentiated and described by C. Correns in Oesterr. Bot. Zeitschr. 1909, 180, 181, and by S. Borza in Bot. Közlem. 1913, 74. They are as follows:—

f. 1. *typicum* nobis.—Caules et folia incano-tomentosa. Petalorum ungues glaberrimi. Filamenta omnia glaberrima. Ovarium infra medium pilosum.

f. 2. *leiostemon.*—Ut f. 1, sed filamenta episepala pilosa.

Hab. Prov. of Croatia; Velnac, above Karlopago, on Mt. Velebit, by the coast (*Kümmerle*). Mt. Jastrebica in Montenegro—now part of Serbia (*Adamovic*).

f. 3. *lasiostemon.*—Ut f. 1, sed filamenta omnia pilosa.

Hab. Prov. of Dalmatia: Mt. Veliki Stirovnik, at 1200 metres.

f. 4. *leiogynum.*—Ut f. 1, sed ovarium etiam glabrum.

f. 5. *glabrescens.*—Planta omnino glabrescens.

Hab. Prov. of Bosnia: on the Vran Planina, near the Herzegovina border, at 2000 metres.

There are also good examples of f. 2 in Herb. Kew—from Mostar in Herzegovina (*Callier*, Pl. Herceg. exs. 1895, n. 32), and Mt. Veliki in Montenegro (*Baldacci*, 1890), in both places at 1200 metres.

C. suffruticosum Linn. has been queried under this species. There is no specimen in Herb. Linn.; and it is not possible to identify it.

145. C. GRENIERI F. W. Schultz, Fl. Gall. et Germ. exs. Cent. 1, no. 16, et Introd. p. 6 (1836); et in Arch. Fl. Fr. et Allem. 24 (1842), etiam *cf.* in Jahrb. Pharmac. 1842; et (pro var.) in Flora, xxiii. abt. 1, 123 (1840); =*C. pumilum* var. γ *viscarium* Rchb. Ic. fl. Germ. Helv. vi. 37, t. 228, f. 4969 *b* (1842), sed in ed. alt. Germ. iii. 107.

This commoner form of *C. pumilum* is better represented in F. W. Schultz, Herb. Normale, n. 27.—Læte viride. Bracteæ superiores margine anguste scariosæ. Pedicelli filiformes. Flores 3–4 mm. long. Caulis primarius 6-15 ctim.—Exactly agrees with Reichenbach's figure.

146. C. HAUSSKNECHTII Boiss. in Oesterr. Bot. Zeitschr. 1876, 410; = *C. macrocarpum* Boiss. et Haussk. (1867).

There was no need for Boissier to have changed the earlier name of this species on account of the alleged "*C. macrocarpum* Schur" (1859). This latter is merely the quite needless raising to specific rank of "*C. vulgatum* var. *macrocarpum* Fenzl" (1842), which is *C. triviale* var. *alpinum* Mert. & Koch (1831).

147. C. HETEROPHYLLUM Viviani, Fl. Libycæ sp. 67, in app., et Fl. Corsicæ sp. nov. 17 (1824)—"Foliis glabriusculis, inferioribus ovatis, superioribus lineari-lanceolatis; calycibus hirsutis, corollæ subæquantibus; capsulis rotundis." Type-specimen, from the mountains of Corsica, in the Hanbury Botanical Institute at Genoa, with Viviani's small collection. Associating the characters of the description with "capsulis rotundis," I very much doubt whether this is a *Cerastium* at all; though it was referred to *C. Illyricum* by Grenier and Godron, Fl. de France, i. 270 (1848). There is no reference to it in Briquet's Prodr. fl. Corse, i. (Oct. 1910), who gives no information about it.

148. C. HIERONYMUSII Pax (*Hieronymi*) in Engl., Bot. Jahrb. xviii. 26 (1893).—Subg. *Orthodon*, sect. Cheileodontia. Perenne. Caules e radice adscendentes plures, steriles abbreviato-rosulati dense glanduloso-hirsuti. Folia crassiuscula approximata, in ramulis fertilibus ovata, in ramulis sterilibus lanceolato-oblonga, omnia plusminus glandulosa, dense ciliata. Flores solitarii vel pauci, pedicellis calycem æquantibus. Bracteæ scarioso-marginatæ. Calyx aperte campanulatus; sepala oblonga acuta vel acuminata scarioso marginata, glanduloso-pubescentia. Petala calycem bis terve superantia spathulato-oblonga biloba, lobis et sinu obtusis. Capsula recta, calycem sequans vel vix superans. Semina angulata, testa vesiculato-inflata nucello multum amplior.

Hab. Argentina; Campo Grande, prov. Catamarca.

Of the habit of *C. montioides*, and nearest to *C. mucronatum*.

149. C. HIRSUTUM Muhlenb. Cat. Plant. Amer. sept. 48 (1813); =*C. glomeratum* Thuill. (1799). Founded on "*C. hirsutum* majus flore parvo" Dillen. Cat. Plant. Gissam nasc. 48 (1719). Recorded from the states of New York, Delaware, and N. Carolina. A *nomen nudum*.

150. C. HIRSUTUM Tenore, Prodr. Fl. Neap. p. xxvii (1811); Cat. Piant. giard. bot. Nap. (1807–1813); Cat. Plant. hort. Neap. 45 (1814); Fl. Napolitana, iv. 237, t. 141, f. 1 (1830); Syll. Plant. vasc. Fl. Neap. 222 (1831); = ? *C. arvense* var. *hirsutum* Spenner, Fl. Friburg. iii. 850 (1821). Tenore's original description is as follows:—"Caule cæspitoso herbaceo, pilis glandulosis patentibus obsito; foliis ovato-oblongis vel ellipticis utrinque acutis, obscure virentibus undique hirtis; floribus paniculatis, corollis calyce duplo longioribus, petalis profunde bifidis; capsulis fertilibus calycibus duplo longioribus." Tenore says that the leaves are quite different from those of *C. arvense* and are more acute, the calyx more scarious, and the petals more deeply bifid. He gives the localities as the higher parts of the Apennines of Abruzzo, as at S. Angelo di Castellamare, and at Mongiana in the south of Calabria. Gussone records the plant from Busambara, in Sicily—Fl. Siculæ syn. i. 510 (1842). Tanfani, in Parl. Fl. Italiana, ix. 500 (1892), simply notes it as "forma meridionalis." Seringe, in Cand. Prodr. i. 421, includes it among the *species non satis notæ*, with the following description:—"Diffusum hirsuto-viscosum, caulibus repentibus, foliis oblongis basi attenuatis hirsutus canescentibus, floribus paniculatis, corollis calyce duplo longioribus, capsulis oblongis subincurvis." It may, however,

be specifically distinct, as I treated it in the Provisional List, and as had been previously suggested by Mr. Lacaita in a letter to Nyman (1884)—see Consp. Fl. Eur. suppl. ii. 359. He thinks that it should be placed near *C. tomentosum*, as the fruit-pedicels are straight (not cernuous as is the case in *C. arvense*), and as is indicated in a MSS. note in Gussone's herbarium at Naples, attached to an authentic specimen—"calyces deflorati erecti sunt, ideoque *C. arvense* esse nequit, in quo calyces deflorati cernui." Moreover, the corolla is much larger than in any form of *C. arvense*. In the Neapolitan mountains of Taburno, Mt. Vergine, etc., there are found various forms (e. g., *C. Graefferi* Guss. herb.) which seem intermediate between *C. hirsutum* and *C. tomentosum*. And, as is mentioned above, Seringe notes an additional character, not alluded to by Tenore—"capsulis oblongis *subincurvis*."

151. C. HIRTELLUM Pomel, Nouv. Mat. fl. Atlant. 205 (1874), ext. Bull. Soc. Climat. d'Alger.—Subg. *Orthodon*, sect. *Schizodontia*. Glutinoso-hispidum, annuum. Radix gracilis. Caulis 4–5 ctim., simplex erectus. Folia ovalia basi paullum attenuata, inferiora rosulata, media ovali-oblonga, summa bracteiformia. Dichasium pauciflorum. Calyx fructifer basi subumbilicatus patens paullum arcuatus, pedicello longior; sepala oblonga subacuminata, interiora late scariosa. Petala biloba, calyce parum breviora. Capsula inclusa recta, dentibus in conum rectis dehiscens. Semina lateritia, valde echinulato-tuberculata.

Hab. Algeria: on damp schistose rocks at Garrouban.

Var. *echinulatum* nobis.—Velutino-glandulosum, elatius. Caulis 10 ctim. Folia 7–8 mm. Sepala et petala 6 mm. Capsula longior, ad 12 mm.

Hab. Algeria: Boghar.—Syn. *C. echinulatum* Battand & Trabut, Fl. de l'Alg. i. 148 (fasc. 1, 1888).

Described from specimens in Herb. Kew. (*Warion*, Pl. Atlant. sel. 1876, n. 40), collected in stony and woody places about Daïa, prov. Oran.

The species is distinct in the character of the seeds, invested with spined tubercles. Its record of occurrence in China is an error, due to misquotation of title-page in one of Debeaux's opuscula.

152. C. HISTRIO Correns in Oesterr. Bot. Zeitsch. 1909, 182.—This is hardly more than a *nomen nudum*. It is founded on specimens collected on a mountain, at high stations, in Yugo-Slavia. Referred to L. Adamovic for examination, they were labelled by him "*C. Banaticum*," which Correns says they do not match. They are in the Vienna Herbarium under n. 50, as the collector's number. Possibly they belong to one of the many forms of *C. grandiflorum* Waldst. et Kit.

153. C. HOCHSTETTERIANUM Fenzl, Verbreit. Fam. Alsin. fol. tab. ad p. 56, nomen (1833); = *C. pyrenaïcum* Gay (1832).

(To be continued.)

SHORT NOTES.

A Defiled Sanctuary. A paragraph in the last issue of this Journal, copied from a daily paper, ought not to pass without notice. It states that the Director of Kew Gardens, with the alpine specialist of the same institution and Mr. N. R. Bulley, had recently visited Snowdon and planted a large tract with roots and seeds of alpine plants from Kew. One might have been inclined to pass this as one of the scientific *jeux-d'esprit* with which the Editor sometimes regales us; but, having recently helped Sir Frederick Moore to repel a similarly well-meant but misguided attack by Mr. Bulley on one of our Irish alpine areas, I fear there may be some truth in it. I think all students of geographical distribution will agree that action of this kind is to be deplored, and may have mischievous results undreamed of by its authors. Were the plants so introduced confined to species which by no stretch of imagination could be expected to occur naturally upon Snowdon—for instance, natives of the New Zealand or Yunnan Alps—no great harm would be done. But if they include plants of the adjoining mountain regions of the Continent, then such action savours of a deliberate attempt to falsify the historical and geographical record. It seems to my mind to be like introducing objects of another dynasty into some unexplored Egyptian tomb, or like scattering exotic shells on the sea-shore for a conchologist to find—as William Turton's daughter did at Portmarnock, with dire results. Should at any future time an alpine plant hitherto unknown on Snowdon be discovered there, it will be impossible to tell whether it is a relic of an ancient glacial flora, or an example of the efficiency of Mr. Irving's work with seeds: and the biogeographical value of the discovery will be seriously impaired. It is difficult enough, as every field-botanist knows, to unravel the tangled skein of the present British flora and endeavour to reconstruct from it with any certainty a picture of the natural vegetation of our country—a picture which is surely of much interest and importance to every thinking man. Is it unreasonable to ask our comrades in the domain of horticulture not to render our task more difficult by throwing sand in our eyes?—R. Lloyd Praeger.

[When we first saw the paragraph to which Mr. Lloyd Praeger takes exception, we thought, as he did, that some hoax had been perpetrated, and we awaited the contradiction which we felt sure would follow. But a fuller statement to the same effect appeared in the *Times*, and no correction ensued, so that we must reluctantly conclude that Sir David Prain has allowed his name to be associated with an enterprise which we do not think Mr. Praeger condemns too strongly.—Ed. Journ. Bot.]

Orchis elodes Griseb. (p. 305). In October 1906, I sent a note on *Orchis elodes* Griseb.; here it is, but you did not put it in. You sent a description of it, and there it ended. But I was right, as I then thought I was.—A. Bennett.

[Mr. Bennett encloses the note, which is as follows:—

"Orchis ericetorum Linton (*Flora of Bournemouth*, p. 208, 1900). Is this 'subspecies' of *O. maculata* the same as *O. elodes*

Grisebach, *Ueber die Bildung des Torfs in den Emsmooren*, &c. (1846), p. 25? From the remarks of Sonder and Garche, I should be inclined to think they were the same, but I have no means of seeing the original description. Perhaps someone who has will look it up, and see if there are specimens in our Herbaria. Grisebach's plant has occurred in Germany (near Hamburg, Ostfreisland, &c.), Holland, and Switzerland.—A. BENNETT. 9. 10. 06."]

PLANTAGO LANCEOLATA L. Since May 1919 I have had under observation plants which differ from the type in the following characters. The stamens remain erect or almost so, and do not become as squarrose as in the type; the filaments are shorter; the anthers are greenish-yellow, and longly-elliptical instead of whitish and oblong-spheroidal as in the type. Many normal plants grew in the vicinity of the original station, and I was at first inclined to regard the abnormal inflorescence as a more or less persistent juvenile condition of the normal one. Subsequent investigation opposes this view, as it has shown that the plant is frequent in the Taunton district, that all its inflorescences have the peculiar characters mentioned above, and that it preserves them throughout the flowering season. This year I placed some of the plants in the garden away from other plantains, and I hope to obtain seedlings next year. In my notes, where I have provisionally placed the plant as var. *anthoviride*, the earliest times of flowering noticed were rather later than for the type, being 25th May, 1919, 13th May, 1920, and 14th April, 1921, as compared with 1st May, 5th April, and 24th March. It is hoped that subsequent examination and experiments of 1922 will enable the status of the plant to be determined.—W. WATSON.

CUSCUTA EUROPÆA L. IN MID-CHESHIRE. During the present summer there has been an extensive growth of the Great Dodder in a potato-field bordering the River Weaver at Acton Bridge, three miles from Northwich. The farmer noticed a yellow patch in the field in July, and found at this spot that the growths of the potatoes were covered over and matted together by the twining tendril-like stems of the parasite. The patch was seven yards in length and comprised several drills across. There were other but smaller patches in other parts of the field. He cannot account for the occurrence, as no seed has been introduced on the farm which could explain it. The potatoes came from Dumfries last year, and oats which were grown on the same field the previous year also came from Scotland.—W. HORTON-SMITH.

ORCHIS HIRCINA IN GLOUCESTERSHIRE. This orchis has this year been found again in E. Gloucestershire. It was a single spike at the edge of a wood on the Cotteswolds, among the older woods where the Red Helleborine flourishes, in the same general neighbourhood as the specimen found in 1917.—H. J. RIDDELSDELL.

REVIEWS.

Strasburger's Text-book of Botany. Rewritten by Dr. Hans Fitting, Dr. Ludwig Jost, Dr. Heinrich Schenck, and Dr. George Karsten. Fifth English Edition revised with the fourteenth German Edition by W. H. Lang, D.Sc., F.R.S., Baker Professor of Cryptogamic Botany in the University of Manchester. 8vo, pp. xi, 799 with 833 illustrations, in part coloured. Macmillans, 1921. Price 31*s.* 6*d.*

A feature of the new edition of this well-known text-book is the recognition of the unofficial title under which the book has been known to English students, namely *Strasburger's Text-book of Botany.* Strasburger's position as the original founder of the text-book is thus recorded, and his name among the authors on the title-page is replaced by that of Professor Fitting, who is now responsible for the section on Morphology. Of the four original authors only one remains, Professor Schenck, who is responsible for the special portion dealing with Thallophyta, Bryophyta, and Pteridophyta.

The book continues to grow in size and seems to have reached the limit convenient for a single volume. Coloured illustrations also continue to form an important feature—not only in the systematic portion where officinal and poisonous species are thus indicated, but for emphasizing contrasts, where this is helpful, as in the illustration of the graft hybrid *Cytisus Adami*, or that indicating segregation of characters in the progeny obtained by crossing the red- and white-flowered forms of *Mirabilis Jalapa.* The general form and plan of the work are similar to those of the original English edition of 1898, but extensive changes have been made in the text-matter, including the substitution of completely new sections on Morphology, Physiology, and Spermatophyta. The greatest alteration is in the first section, that dealing with Morphology. This was in the earlier editions subdivided into two sections dealing respectively with external morphology and internal morphology or histology and anatomy. The treatment has been revised and the space devoted to this division much increased, there being now four sections—I. Cytology, on the cell, the protoplast, and their cell-contents; II. Histology on tissues and tissue-systems; III. Organography; and IV. A short section on the theory of descent and the origin of new species, in which evidence is brought forward in support of a theory of evolution, and the two hypotheses—Lamarckism and Darwinism—are contrasted. Incidentally this last section illustrates a weakness of the plan of the book; there is no reference here to more recent views as to the origin of species, but in the division on Physiology, under the section headed Development, a few pages, in which allusion is made to Mendelism, are devoted to it and to heredity and variability. Professor Jost's treatment of Physiology is under three headings—Metabolism, Development, and Movement.

In Part II, Special Botany, a systematic account of the great groups of plants and their subdivisions, the arrangement is, in the main, on the system developed by Engler from that of Eichler. In the Pteridophyta recent and fossil groups are considered together and arranged in five classes—Filicineæ, Equisetineæ (including the fossil Calamites), Sphenophyllinæ (Palæozoic), Lycopodinææ (including two extinct families, Sigillariaceæ and Lepidodendraceæ), and Pteridospermæ, which in the edition of 1908 were regarded as fern-like seed-plants. To these classes the editor has added in a foot-note the Psilophytales, to our knowledge of which he has himself so greatly contributed. In the arrangement of the Angiosperms the Dicotyledons precede the Monocotyledons, the latter being regarded as derived from the Polycarpic group of Dicotyledons.

A. B. R.

Devonian Floras: a Study of the Origin of Cormophyta. By Dr. E. A. Newell Arber, with a Preface by Dr. D. H. Scott. 8vo, pp. 100, fig. 47. 17*s.* 6*d.* Cambridge Univ. Press. 1921.

The search for origins has a special fascination, and the late Dr. Newell Arber had the happy idea of collecting together our fragments of knowledge with regard to the earliest-known land-plants. It was unfortunate that he did not live to complete the generalisations which were based on his survey of the material, and still more that he should not be destined to know of the important discoveries made by Kidston and Lang in the Rhynie Chert and published more recently. As stated in the Preface, however, it seemed to Dr. Scott that the work was advanced sufficiently far for publication when the author died, and contained a valuable contribution to botanical thought; hence it has been edited by Mrs. Arber and published by the Cambridge University Press.

In this volume we are provided with an illustrated summary of the fossil plants known from the Devonian rocks and shown some of the weird types which flourished at that remote epoch. This is a worthy task, for the previous descriptions of these plants are scattered through the literature of several countries, and in some cases no modern account of them exists; thus the only descriptions of some of the Scottish plants of the Old Red Sandstone are in the original writings of Hugh Miller.

From the material so exposed, a sketch of the probable origin of these plant-types is given, and this is interesting, even though we may not be able to agree with all of it. The author regarded most, if not all, of the Lower Devonian plants, such as *Psilophyton*—with which *Rhynia* is included—as Thallophytes, in spite of their possession of stomata and simple vascular systems. He does not "urge that they were Algæ in the sense in which that group is usually defined from a knowledge of its living members," but regards them as probably higher in the scale of complexity, and of a land habit. He does not, however, define what he means by the term Thallophyte, and it would seem a matter of indifference whether we regard them as very complex Thallophytes or very simple Pteridophytes. Dr. Arber was strongly of the opinion that these early types could not be regarded as forms, and his insistence upon their Thallophytic nature seems to be based on the feeling that, if classed as

Pteridophyta, they might be considered as reduced rather than as primitive forms.

As a friend and a former pupil of the author, the writer feels at times that sickness must have begun to affect his mental powers during the writing of this work; for in several places there is a tendency to dogmatise, and he scarcely seems to have appreciated the extreme caution with which Kidston and Lang compared the rootless *Rhynia* with the only modern rootless Pteridophytes, viz. the Psilotaceæ. Recently Dr. J. Horne has pointed out a quite unaccountable mistake in classification of the Old Red Sandstone plants given in the early part of the book, where the Caithness plants are stated to be of Upper O.R.S. age.

As Dr. Scott points out in his Preface, Arber's views on the polyphyletic origin of the higher plants have something in common with the brilliant speculations of Dr. A. H. Church. This conception is one which must exercise a marked influence on botanical thought, for it has to be considered, even if it is not regarded by all as well founded. Should the polyphyletic hypothesis prove of lasting value, *Devonian Plants* will stand as a book of importance in the development of botanical thought; in any case it contains a store of interesting information about the plants of very remote antiquity.

H. H. T.

BOOK-NOTES, NEWS, ETC.

At the meeting of the Linnean Society on November 3, Dr. Daydon Jackson gave an account of the recently-completed Catalogue of the Linnean Herbarium. He stated that his first reference was made nearly fifty years ago, when he found that Mr. R. Kippist, at that time Librarian, could not explain certain signs employed by Linnæus, the meaning of which had been lost. The speaker's first published contribution to a knowledge of the herbarium was made in 1888, on the Centenary Anniversary of the Society, when he was commissioned by the President, Mr. W. Carruthers, to draw up an account of the growth of the collections, their purchase by Dr. J. E. Smith, and, lastly, their acquisition and tenure by the Society. In turn followed an account of the Banksian desiderata supplied from the Linnean stores; the List of the genera with the number of sheets in each; and the Index issued in 1913. A diversion to the zoological collections came to publication in the next year; then Tulbagh's considerable collection in 1918; and, finally, the present MS., which has taken more than two years to compile. The guiding idea has been to supply the answer to future enquiries by giving the writer's name to each label or comment, wherever possible, the Linnean letters affording an invaluable help in identifying handwriting. The MS. has been drawn up for reference in later years; it includes the interpretation of many signs used by Linnæus, the meaning of which had been lost for more than a century, but was now rediscovered. Lantern-slides in explanation of these points were shown.

At the same meeting Mr. James Groves presented a paper on Charophyta collected by Mr. Thomas B. Blow in Ceylon. He prefaced his remarks by referring to the great services Mr. Blow had rendered in making large collections of these plants in the course of travels in many parts of the world; and to the great beauty and excellence of the specimens, some of which were exhibited, due to Mr. Blow's care and attention in floating them out, in spite of the work having often to be done under very difficult conditions. The first visit to Ceylon was in November 1895, when some of the plants were immature, the second in January 1898, when they were in good fruiting condition. The collection, by far the most extensive which has been made in the Island, consisted of 13 species, one of which was regarded as new. Only one of them occurred in Europe, the rest being mostly confined to the tropical and subtropical regions of the two hemispheres, and a few to Southern Asia and the Malay Archipelago and the Philippine Islands.

The *New Phytologist* (xx. n. 4: Nov. 2) contains a continuation of Mr. Walter Stiles's paper on "Permeability"; the first part of "A Study of some Factors controlling the Periodicity of Freshwater Algæ in Nature," by Mr. W. J. Hodgetts, based upon the observations of three-and-a-half years on the growth and reproduction of the algæ of a pond near King's Norton, Birmingham; and an article by Dr. Fritsch on "Thalassiophyta and the Algal Ancestry of the Higher Plants," based on Dr. Church's Oxford Botanical Memoirs No. 3.

The *Botanical Gazette* for October contains an interesting paper by Duncan S. Johnson on "*Polypodium vulgare* as an Epiphyte."

The *Annals of Botany* (October) contains a continuation of "Observations on the Anatomy of Teratological Seedlings" (*Impatiens Roylei*, i. e. *I. glandulifera*) by H. S. Holden and Margaret E. Daniels; "Endemic Genera of Plants in their Relation to others" by J. C. Willis; on the endemic species of the Canary Islands by H. B. Guppy and on endemism in the Bahama Flora by Norman Taylor; Winifred E. Brenchley and Violet G. Jackson write on "Root Development in Barley and Wheat"; W. P. L. Waterhouse on the infection of *Berberis vulgaris* by sporidia of *Puccinia graminis*; E. J. Hatfield on the anatomy of *Macrozamia Fraseri*; J. Lloyd Williams on fertilisation in *Laminaria* and *Corda*; W. N. Edwards on fossiliferous wood from Kerguelen Island.

The *Naturalist* for November contains a description by Mr. R. W. Butcher (with figure) of *Tillæa aquatica*, the discovery of which at Adel, near Leeds, was briefly mentioned in our last issue (p. 335). From the same number we learn of the death of Frederick Arnold Lees, which occurred at his residence—Meanwood, Leeds, on Sept. 17; we hope to give some account of his work later.

The new part (Stuttgart, 1921) of *Bibliotheca Botanica* is devoted to a continuation of K. Domin's "Beiträge zur Flora und Pflanzengeographie Australiens." The orders treated (in Englerian sequence) run from *Casuarinaceæ* to *Amarantaceæ*: many new species are described, and there are four plates, with illustrations, in in the text. We note that in *Proteaceæ* Knight's specific names are maintained, in preference to the more generally employed but later ones of Robert Brown. We regret that the too common practice of leaving the heads of the pages blank instead of employing them—to the great convenience of the consultor—for conveying useful information as to what is below them, is followed in this important work.

THE *Kew Bulletin* (No. 7) contains a "Revision of the Genus *Tryphostemma*," by J. Hutchinson and K. Pearce—twenty-five species are enumerated, of which six are new; an account of "N.W. Himalayan *Astragali* of the Subgenus *Ægacantha*" by R. W. Parker; "A Revision of the Genus *Belotia*, by T. A. Sprague—eleven species, six being new; "New or Noteworthy South African Plants," by J. Burtt-Davy; this contains notes on *Cynodon transvaalensis*, distinguished from *C. Dactylon*, and on *Erigeron canadensis* L. (N. America) and *E. linifolius* Willd. (Asia), two species often confused in herbaria.

MR. N. E. BROWN is publishing in *The Gardeners' Chronicle* an interesting series of papers on *Mesembryanthemum* and some new genera separated from it. The series began in the issue of Sept. 3, and will form a valuable contribution to the history of a genus on which Mr. Brown is a recognised authority. The *Chronicle* is also publishing a continuation of the late Reginald Farrer's notes on his second exploration in Asia.

WE are glad to note that the Watson Exchange Club has been able to reduce to 10*s*. 6*d*. the subscription which was raised last year to 14*s*. The Distributor for the present year is Mr. W. R. Sherrin, of the South London Botanical Institute, 323 Norwood Road, S.E. 24, to whom parcels should be sent before Jan. 6.

M. E. G. CAMUS has recently published (Lechevalier, Paris) an *Iconographie des Orchidées d'Europe du Bassin Méditerranéan*, with the collaboration, for the anatomical portion, of M. A. Camus; it contains 122 folio uncoloured plates, in which a large number of hybrids are included.

DR. E. DE WILDEMAN, who last year published an account of the Mission Forestière et Agricole to Mayumbe (Belgian Congo) undertaken by Count Jacques de Briey in 1912, issued in July a *Contribution à l'étude de la Flore du Katanga*, in which the economic properties of the plants are dealt with and some new species are described. Both works are published at Brussels by D. Reynaert.

MR. J. S. GAMBLE'S *Flora of the Presidency of Madras* (Adlard & Son, 10*s*. net) continues to make steady progress; the fourth number just issued contains the orders *Rubiaceæ* to *Ebenaceæ*. The genera are very fully described, with clavis to each; the descriptions of the species, also quite full, are embodied in the clavis to these—there is also a short popular description; the geographical distribution and local names of each are also given. The Flora is very well printed, and the size is convenient for the pocket.

WE regret to announce that Dr. Wernham has been compelled by ill-health to resign his post in the Department of Botany.

WE are glad to announce that Miss Matilda Smith, who has been so long associated with Kew as botanical artist, has been elected an Associate of the Linnean Society.

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ERRATA.

P. 32, l. 12 from top, for "Howard" read Stoward.
P. 155, l. 11 from top, for "*Silaus*" read *Silaum*.
P. 237, l. 22 from top, for "*affine*" read *angustifolium*.
P. 239, l. 21 from bottom, for "Dymes" read Dykes.

Obvious literals are not included here.

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In view of the fact that the stock of these is in some cases practically exhausted, the attention of our readers is directed to the list which appears on the following page. Old subscribers of course already possess the matter contained in them in the pages of the *Journal*; but some of them appeared several years ago, and recent subscribers will thus not possess them. Some, which do not appear in the list, are already out of print; of others very few copies remain, and it will of course be impossible to reprint them: among the latter may be mentioned Mr. Dallman's *Notes on the Flora of Denbighshire* (1911), and Mr. Bennett's *Supplement to 'Topographical Botany.'* Of the Supplements to the *Biographical Index* no complete sets remain. It had been hoped before this to issue the second edition of the work, in which these Supplements are of course incorporated, but the present cost of paper and labour has rendered this impossible. Of the *Index* itself no copies remain, these having been lost in the course of transferring the stock to Messrs. Adlard. Mr. Garry's *Notes on the Drawings of Sowerby's 'English Botany,'* containing, as it does, much topographical information and numerous unpublished notes by Smith, Sowerby and others, should be in the possession of all interested in the history of British Botany: only sixteen copies remain.

It may be pointed out that, although for the most part relating to British Botany, certain of the reprints have a more general appeal. Such are the *Index Abecedarius*—a list of the plants in the first edition of Linnæus's *Species Plantarum*, showing at a glance what are included in that work, which has no index of species; the *History of Aiton's 'Hortus Kewensis,'* which contains much information as to the authors and contents of that classical work; the *Flora of Gibraltar*, which, besides a complete list, contains notes on the more interesting species; Linnæus's *Flora Anglica*—the first English Flora—has a bearing upon nomenclature: of all these there are numerous copies.

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